KHS Ecology & Bushfire

Biodiversity Development Assessment Report

for proposed residential subdivision,
10 Col Drewe Drive, Bowenfels NSW

October 2023 (revised 8 December 2023)

Prepared for: Lithgow City Council

Prepared by: KHS Ecology & Bushfire Pty Ltd

Report title:

Biodiversity Development Assessment Report for proposed residential subdivision, 10 Col Drewe Drive, Bowenfels NSW

Prepared for:

Lithgow City Council (LCC)

Contact: Sherilyn Hanrahan
Strategic Land Use Planner
Lithgow City Council
T: 026354 9906
E: sherilyn.hanrahan@lithgow.nsw.gov.au

Prepared By:

KHS Ecology & Bushfire Pty Ltd
Dr Kate Hammill, BAM Accredited Assessor BAAS 18022
PO Box 8, Mudgee NSW 2850
ABN 55 651 586 70
E: kate@khsecology.com.au

BAM CASE: 00042512/BAAS18022/23/00042513

Document versions:

Version	Date	Author	Comment
0	29.10.2023	K. Hammill	BDAR submitted to Lithgow City Council for comment address by minor edits
0	31.10.2023	K. Hammill	BDAR submitted to LCC for review by DPE / Hunter Ecology
1	8.12.2023	K. Hammill	Revised BDAR to address critical review by DPE / Hunter Ecology - amended credit calculations for *Chalinolobus dwyeri*, additional maps and tables, engineers advice on unavoidable impact to one hollow-bearing tree, additional recommendations for a vegetation management plan to provide a habitat corridor and vegetation areas to mitigate impacts not addressed through credits.

Disclaimer

This report was prepared in good faith and based on the information available at the time of the assessment and the limitations as stated. The report follows the relevant methods and guidelines, as far as practical and within the agreed scope of the assessment, however no guaranteed is made that the report is free of errors or omissions. The consent authority may differ in their assessment or findings and will make the final decision on any requirements in relation to the subject matter of this report. This document may only be used for the purpose for which it was intended and in accordance with the contract between KHS and the property owner. KHS accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report, its findings or recommendations or any supporting material in relation to any damage or loss to interested parties.

Declarations

i. Certification under clause 6.15 *Biodiversity Conservation Act 2016*

I certify that this report has been prepared based on the requirements of, and information provided under, the Biodiversity Assessment Method and clause 6.15 of the *Biodiversity Conservation Act 2016* (BC Act).

Signature:  Dr Kate Hammill

Date: 8/12/2023

BAM Assessor Accreditation no: BAAS 18022

This BDAR has been prepared to meet the requirements of BAM 2020. Appendix A provides an assessment of compliance with the minimum information requirements outlined in BAM Appendix K.

ii. Details and experience of author/s and contributors

Name	BAM Assessor Accreditation	Position/ Role	Tasks performed	Relevant qualifications
Dr Kate Hammill	BAAS 18022	BDAR author, BAM Assessor, Vegetation Survey	Vegetation survey	Refer to Table 1-2
Dr Meredith Brainwood		BAM Fauna Ecologist	Targeted fauna survey for Owls, Glossy Black-Cockatoo, survey results	Refer to Table 1-2
Dr Anne Carey		BAM Fauna Ecologist	Targeted fauna survey for Owls, Glossy Black-Cockatoo, survey results	Refer to Table 1-2

iii. Conflict of interest

I declare that I have considered the circumstances and there is no actual, perceived or potential conflict of interest.

This declaration has been made in the interests of full disclosure to the decision-maker. Full disclosure has also been provided to the client.

Signature:  Dr Kate Hammill

Date: 8/12/2023

BAM Assessor Accreditation no: BAAS 18022

Summary

Lithgow City Council is proposing a new residential subdivision of land at 10 Col Drewe Drive, Bowenfels (Figure 1-1). The site is owned by Lithgow City Council and comprises part of Lot 1 DP 1268778, with small portions of Lot 2 DP 1268778, Lot 2 DP 1049398 required for road turning areas. A further Lot 5 DP 1268778 is an existing road reserve dedicated to Council. The development site is zoned Residential R1 under Lithgow LEP 2014 with a minimum lot size of 400m^2.

The subject land is currently vacant land with vegetation comprising derived grassland with a history of grazing. The proposal exceeds the area threshold for the BOS on the following basis.

- Land zoning is R1 - General Residential, with a minimum 400 m². The native vegetation area threshold for the BOS applicable to the development is 0.25 ha.
- The area threshold for a streamlined assessment approach under the BAM is 1 ha.
- The area of the development site is approximately 4.606 ha, excluding the dedicated road reserve (Lot 5 DP 1268778). This is the total area assessed for the BAM. The native vegetation extent has been adjusted for a derived grassland site based on the proportion (%) of native cover across the site, as outlined below and produced an adjusted area of 2.579 ha.

The vegetation on the site is identified as the following type/s:

- PCT 3348 Southern Tableland Granites Ribbon Gum Grassy Forest.

The PCT identification is based on the tree species present around (not within) the development site comprising *Eucalyptus viminalis, Eucalyptus dives, Eucalyptus pauciflora,* in addition to the site being within the Cox's River at an elevation of 940-960m asl. The groundcover is mise native and non-native species and includes *Themeda triandra* (Kangaroo Grass) and *Poa labillardieri*, although these species are rare and only occur in a small area in the centre of the site. PCT 3348 is assigned to the entire development site as a derived grassland.

PCT 3348 Southern Tableland Granites Ribbon Gum Grassy Forest is not associated with a threatened ecological community TEC, as documented in the BioNet Vegetation Information System database description for the PCT. The proposal will not impact a TEC.

One vegetation zone has been mapped within the subject land, PCT 3348 derived grassland. Two BAM plots have been surveyed according to the BAM and have determined a VI score of 10.3. The future VI score will be zero due to the entire site being subject to development, producing a change in VI of -10.3. Based on the zone area of 4.6 ha and a vegetation integrity loss of 10.3, the assessment has calculated zero ecosystem credits.

The subject land is assessed as habitat for *Chalinolobus dwyeri* Large-eared Pied Bat (non-breeding habitat) due to being within 2km of cliffs and potential caves on Hassans Walls and containing a PCT associated with this species. The species polygon is mapped across the entire development site of 4.6 ha, which contains the associated vegetation community, PCT 3348 derived grassland. The assessment has calculated 35 species credits for *Chalinolobus dwyeri* Large-eared Pied Bat required to be offset unless it can be demonstrated that the species is absent from the site by targeted survey.

The following SAII species are relevant to the proposal and have been addressed in this assessment. It is concluded that the development will not impact any SAII species.

- *Asterolasia buxifolia* – no suitable habitat is present on the site, surveyed and found not present.
- *Petrogale penicillata* Brush-tailed Rock-wallaby – no suitable habitat is present on the site, there is no connectivity to potential habitat in the Hassans Walls Reserve due to surrounding development.
- *Chalinolobus dwyeri* Large-eared Pied Bat, is a serious and irreversible impact (SAII) species for breeding. The TBDC identifies potential breeding habitat is PCTs associated with the species within 100m of rocky areas containing caves, or overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings. The current development site is not potential breeding habitat for Large-eared Pied Bat due to nearest cliffs and caves being located in the Hassans Walls reserve approximately 1km to the east of the subject land.
- *Mixophyes balbus* Stuttering Frog – no suitable habitat is present on the site.

The offset requirements for the project have been calculated as the following biodiversity credits:

- zero ecosystem credits for PCT 3348,
- 35 species credits for *Chalinolobus dwyeri* Large-eared Pied Bat, assumed present for foraging due to the site being within 2km of cliff lines in Hassans Walls reserve (refer to BAM-C outputs in Appendix C).

The proposed subdivision includes the retention of a substantial portion of Lot 1 DP 1268778 as open space. This area is located between the *Phragmites* wetland to the south and the land creek corridor and forest areas on Council-owned land to the west. This area provides a suitable location for a 'habitat corridor' to be identified, managed and restored as a separate mitigation measure to the credits required to be offset. A vegetation management and habitat restoration plan is recommended to be prepared for this area to address the objective of 'no net loss to biodiversity' in NSW.

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Figures and Tables

1 Introduction

1.1 Background

KHS Ecology & Bushfire was engaged by Lithgow City Council in August 2023 to prepare a Biodiversity Development Assessment Report (BDAR) for a proposed residential subdivision of land at 10 Col Drewe Drive, Bowenfels, within the city of Lithgow NSW. A Development Application for the subdivision has been lodged by Council since December 2022 and is being reviewed by the Department of Planning. This BDAR has been prepared as part of a request for additional information.

This report sets out the biodiversity assessment undertaken in accordance with the Biodiversity Assessment Method 2020 (BAM) (DPIE (2020), including the landscape assessment, site survey of vegetation integrity and threatened species, identification of vegetation zones and calculation of biodiversity credits produced by the proposal.

NOTE: This report has been prepared in good faith and in accordance with the Biodiversity Assessment Method 2020 (BAM) as far as possible within the time constraints imposed by the client. It is acknowledged that consent authorities or an expert reviewer may form a different opinion on the subject matter presented in this report and may or may not impose further assessment requirements, if warranted.

1.2 Description of the proposal

Lithgow City Council (Council, the proponent) is proposing a new residential subdivision of land at 10 Col Drewe Drive, Bowenfels (**Figure 1-1**). The Development Application seeks approval for staged residential subdivision of one existing allotment to create 46 Torrens Title residential lots and one residue lot allowing for residential development compliant with the current Lithgow Local Environmental plan 2014 and Lithgow Development Control Plan 2021. The proposed housing diversity provides opportunity for residential development ranging from detached residential dwellings to semi-detached dwellings, row housing and secondary dwellings.

The site is owned by Lithgow City Council and comprises part of Lot 1 DP 1268778, with small portions of Lot 2 DP 1268778, Lot 2 DP 1049398 required for road turning areas. A further Lot 5 DP 1268778 is an existing road reserve dedicated to Council. The development site is zoned Residential R1 under Lithgow LEP 2014 with a minimum lot size of 400m^2.

The subdivision plans have been prepared by prepared by J. Wyndham Prince Consulting Civil Infrastructure Engineers & Project Managers, with the latest version shown in **Figure 1-1**.

The site map is provided in **Figure 1-2**. The location map is provided in **Figure 1-3**.

The proposal is situated on Council-owned land that adjoins land to the north (Lot 2 DP 1049398) which has an approved plans for a separate residential subdivision (DA142/18), approved by Council in 2022. The layout for the current Council proposal has some constraints associated with proposed road linkages to the adjoining approved subdivision. A letter from the project engineer (J. Wyndham Prince Consulting Civil Infrastructure Engineers & Project Managers, dated 5/12/2023) is attached at **Appendix E**. This outlines the engineering constrains to the design in relation to unavoidable impact to one habitat tree and measures to avoid impact to a second habitat tree.

Figure 1-1. The proposed subdivision layout (prepared by J. Wyndham Prince Consulting Civil Infrastructure Engineers & Project Managers, plan amendment date 19/05/23)

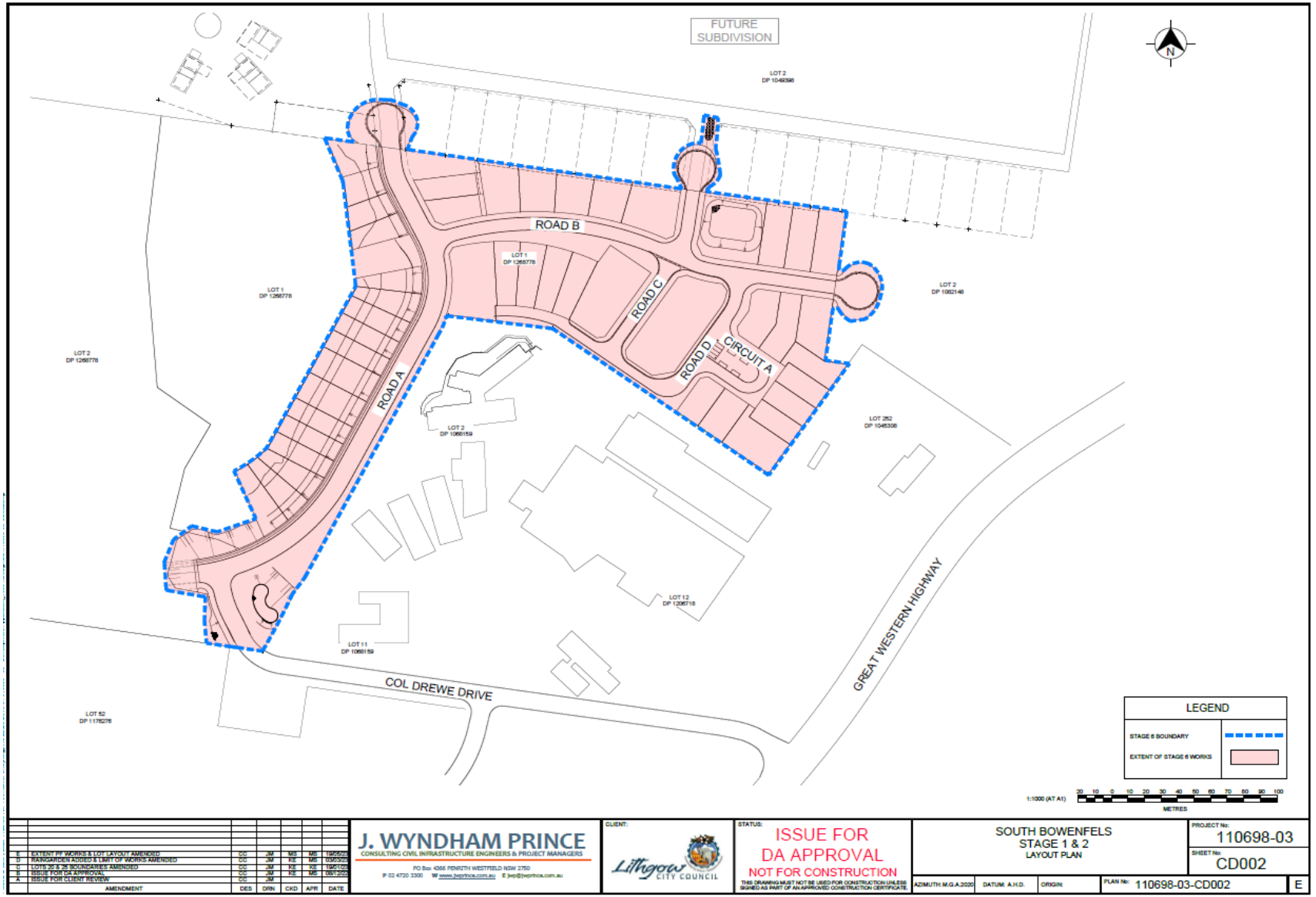


Figure 1-2. Site map with proposed development overlay.

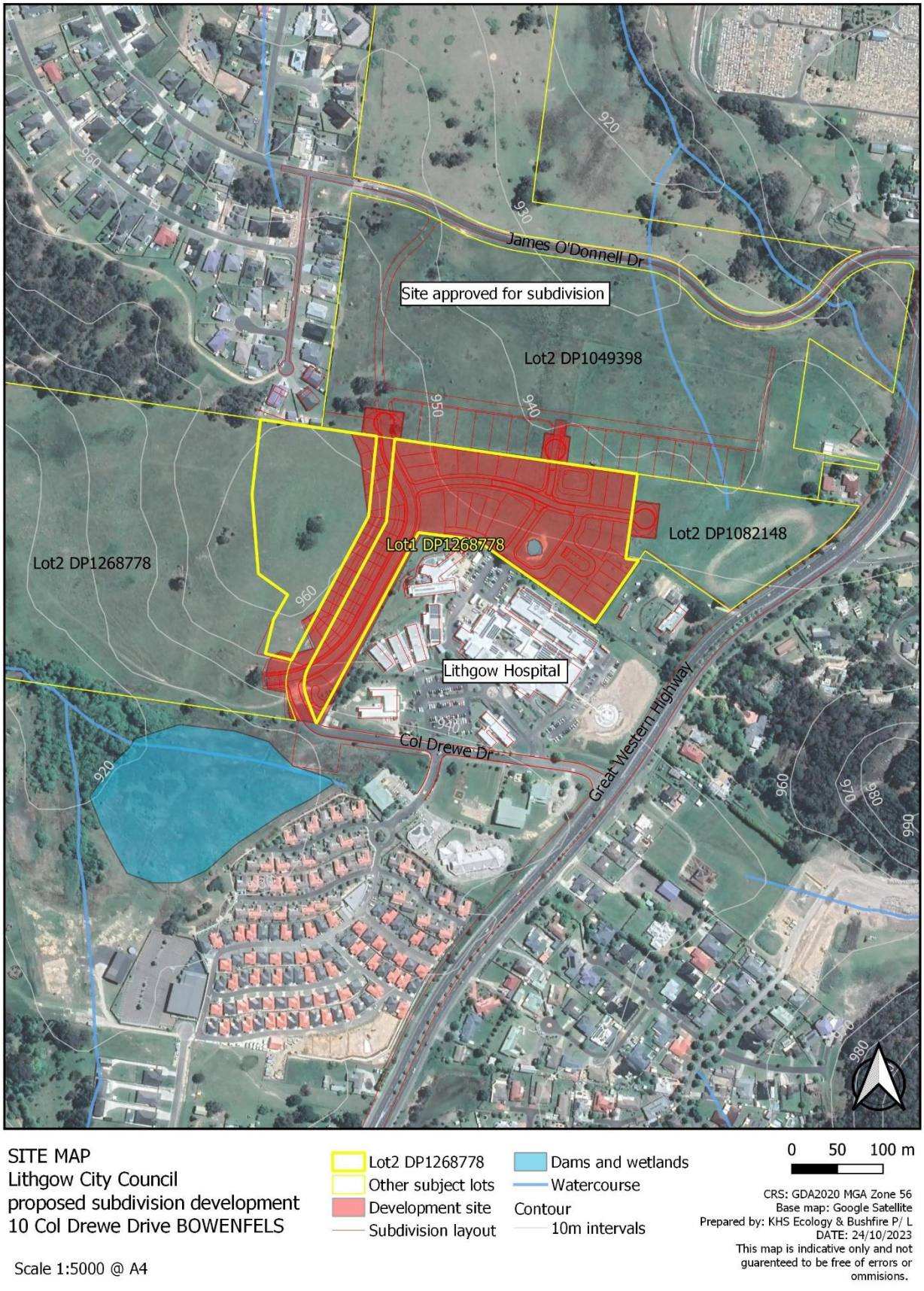
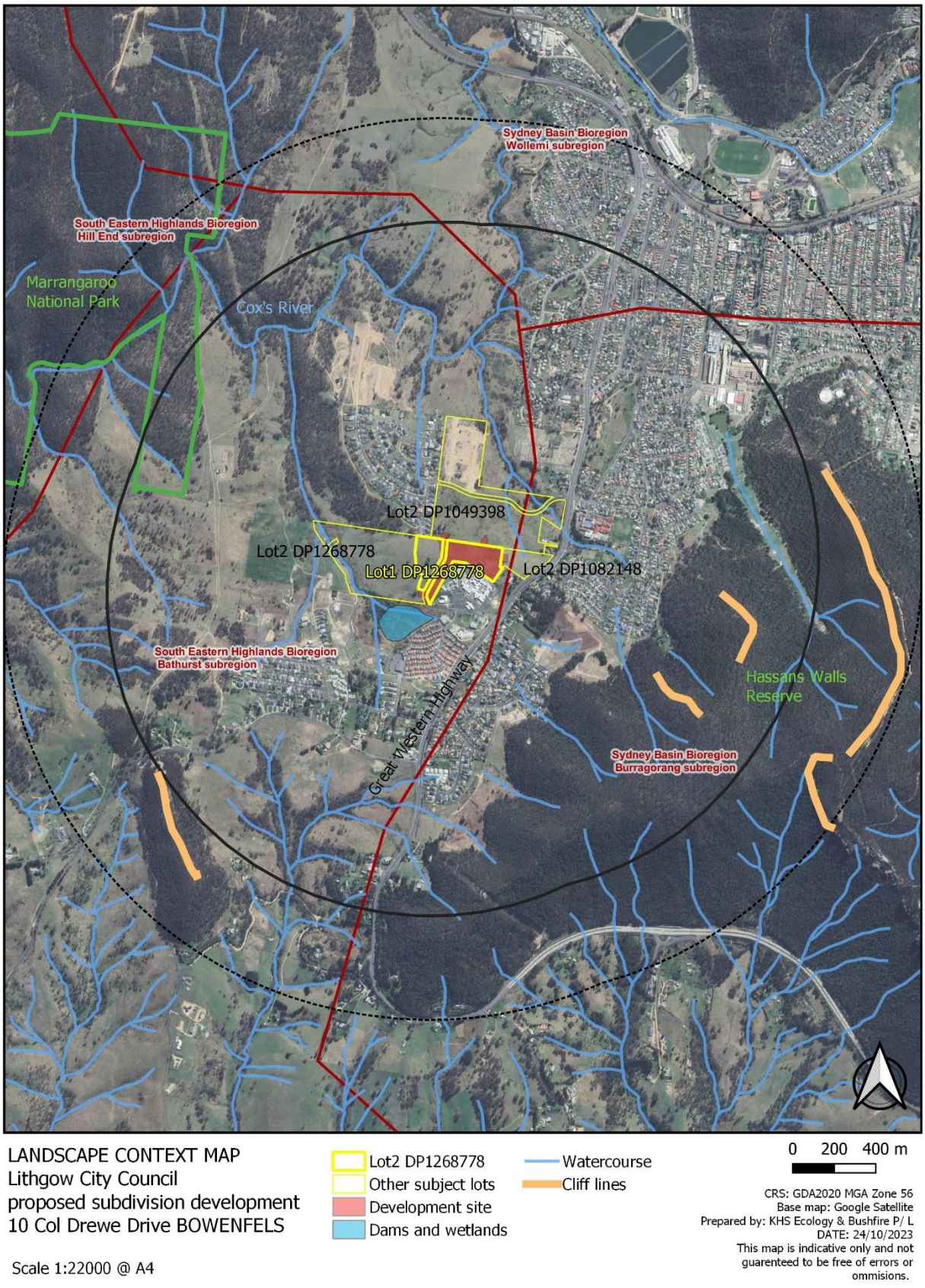


Figure 1-3. Landscape map.



1.3 Objectives and scope

This assessment seeks to address the requirements of the *Biodiversity Conservation Act 2016* (BC Act) in relation to the application of the BAM and the Biodiversity Offset Scheme (BOS), as applicable to the location and size of the development proposal. The assessment documents the proposed impact to native vegetation and threatened species habitat and calculation of biodiversity credits required under the BOS.

1.4 Plans and information sources

The following plans and data sources have been used to inform this assessment.

- Proposed subdivision plans prepared by J. Wyndham Prince Consulting Civil Infrastructure Engineers & Project Managers, plan amendment date 19/05/23 (**Figure 1-1**).
- *The Vegetation of the Western Blue Mountains including the Capertee, Coxs, Jenolan & Gurnang Areas*, vegetation map published by the Department of Environment and Conservation (DEC 2006).
- NSW Government spatial data SIX Maps imagery , cadastre and topographical datasets (www.maps.six.nsw.gov.au).
- BioNet databases including Threatened Species profiles, Wildlife Atlas and Vegetation Information System (VIS) (www.bionet.nsw.gov.au).
- Flora of NSW (Harden 1991-2002) and Flora NSW Online (www.plantnet.rbgsyd.nsw.gov.au).

1.5 Land identification

The primary lot proposed to be subdivided is identified as follows.

- Address: 10 COL DREWE DRIVE BOWENFELS 2790
- Local Government Area: Lithgow
- Lot/Section/Plan No: 1/-/DP1268778
- Land Zoning: R1 - General Residential and C3 - Environmental Management (**Figure 1-4**)
- Minimum Lot Size: 40 ha and 400 m²
- Environmentally Sensitive Land: Sensitive Land Areas
- Riparian Lands and Watercourses: Environmentally Sensitive Areas - Groundwater
- Terrestrial Biodiversity: Biodiversity

Part of the proposed subdivision development also covers small areas within the following adjoining lots (refer to **Figure 1-2**).

- Lot 5 DP 1268778 being the road reserve dedicated to Council and where some proposed lots will be located.
- Lot 2 DP 1049398, where two road cul-de-sacs are proposed on the northern side of the subdivision.
- Lot 2 DP 1082148, where a road cul-de-sac is proposed on the eastern side of the subdivision.
- Lot 2 DP 1268778, where a road cul-de-sac is proposed on the southern side of the subdivision.

The areas relevant to the development site are summarised in **Table 1-1**.

Table 1-1. Subject lot/DP and areas proposed for the development.

Lot / DP	Total lot area (m²)	Development area (m²) (calculated in GIS)
Lot 1 DP 1268778	63643	41428
Lot 2 DP 1268778	133653	1253
Lot 5 DP 1268778	Dedicated road reserve not assessed under the BAM	
Lot 2 DP 1049398	209239	2310
Lot 2 DP 1082148	21893	1070
Total		**46061 (m²)**

Figure 1-4. Land zoning (https://www.planningportal.nsw.gov.au/spatialviewer/, accessed 24/10/23).

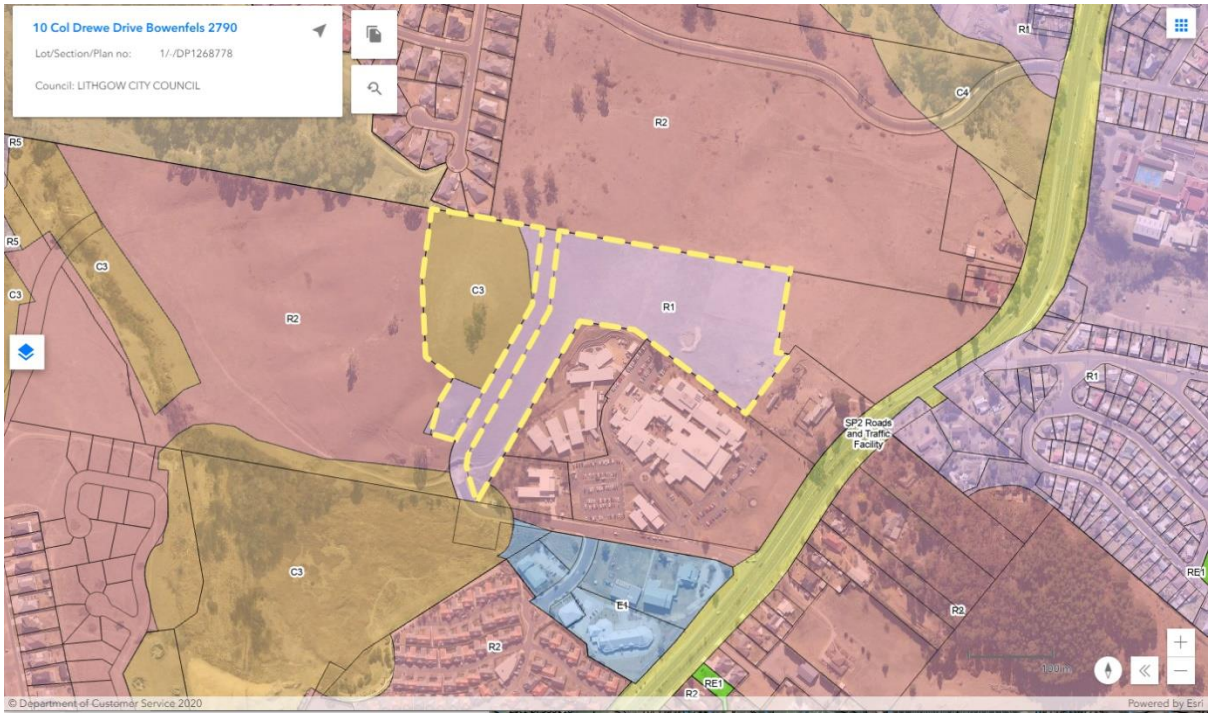


Figure 1-5. Terrestrial Biodiversity mapped land (https://www.planningportal.nsw.gov.au/spatialviewer/, accessed 24/10/23).

Figure 1-6. Biodiversity Values Map in relation to the subject land (https://www.planningportal.nsw.gov.au/spatialviewer/, accessed 24/10/23).

1.6 Defining terms

This assessment uses the following terms to define the study area.

Subject land – refers to the land subject to the development, defined by the subdivision footprint including roads and proposed lots; also referred to as the 'development site'.

Assessment area – The assessment area refers to the subject land and a 1500 m (or 500m for linear proposals) buffer around the subject land examined in the landscape assessment as required by the BAM.

1.7 BOS threshold

The subject land is currently vacant land with vegetation comprising derived grassland with a history of grazing. Adjustment to calculating the area of clearing for the application of the BOS entry threshold can be applied to vegetation that consists of partially exotic groundcover for derived plant community types that are heavily disturbed[1].

The following considerations are relevant to the BOS threshold and have been used to determine whether the threshold is exceeded.

- Land zoning is R1 - General Residential, with a minimum 400 m². The native vegetation area threshold for the BOS applicable to the development is 0.25 ha.
- The area threshold for a streamlined assessment approach under the BAM is 1 ha.
- The area of the development site is approximately 4.606 ha, excluding the dedicated road reserve (Lot 5 DP 1268778). This is the total area assessed for the BAM. The native vegetation extent has been adjusted for a derived grassland site based on the proportion (%) of native cover across the site, as outlined below and produced an adjusted area of 2.579 ha.

[1] Once the proportion of exotic to native vegetation in the ground cover has been calculated via a robust and repeatable scientific method such as the ground cover quadrat field assessment method, the following ruleset is applied:

- where there is greater than 75% native vegetation in the ground cover then treat the vegetation as 100% native and assess the area to be cleared accordingly
- where the proportion of exotic to native vegetation in the ground cover is between 15-75% - the calculation of native vegetation extent is adjusted by multiplying the proportion (%) of native cover by the total area to be cleared
- where there is less than 15% native ground cover all vegetation can be considered exotic and the area clearing threshold will not be exceeded.

The adjustment does not apply in the certain circumstances, as follows.

- The primary community type is naturally a grassland plant community.
- The vegetation meets the definition of a threatened ecological community (TEC) according to the scientific description in the final determination published by the Threatened Species Scientific Committee.
- The vegetation meets the definition of a threatened ecological community or habitat for a species listed under the EPBC Act.
- The assessment of Category 1-exempt land or land categories under the Local Land Services Act 2013.

- The primary (pre-clearing) vegetation community type is a woodland and is not naturally a grassland plant community (refer to section 3.3).
- The vegetation is not part of a TEC (refer to section 3.4).
- The subject site land is not located on land on the Biodiversity Values Map (Figure 1.6).

On the basis of the above considerations, the proposal exceeds the area threshold for the BOS and is not a streamlined assessment.

Proportion of exotic to native groundcover is between 35% and 75%, as determined from the two vegetation integrity plots surveyed on site (refer to section 3.5). According to the area adjustment approach (i.e. where the proportion of exotic to native vegetation in the ground cover is between 15-75% - the calculation of native vegetation extent is adjusted by multiplying the proportion (%) of native cover by the total area to be cleared), the native vegetation extent for the purpose of the BOS threshold has been calculated as follows.

Proportion of native cover x area of the site = 56% x 4.606 ha = 2.579 ha

1.8 BAM approach

This assessment applies the *Biodiversity Assessment Method* (BAM) (DPIE 2020). The assessment documents the native vegetation at the site, threatened species habitat and survey findings. The subject land has one vegetation zone, being the site PCT in a derived grassland form with different mixed native and non-native ground cover. For the site area of 4.6 ha, the minimum number of vegetation integrity plots is two plots required in accordance with the BAM. The impact of the subdivision has been calculated in terms of the type and number of ecosystem and species credits which is the offset requirement of the development.

The threatened species assessment was informed by the data and information held in the Threatened Biodiversity Data Collection (TBDC) including BioNet (DPE 2023a, 2023b) as well as the field observations and the preliminary BAM-C outputs.

1.9 BAAS case identification and submission

The assessment case was created in the BAM-C on 14/07/2023 and has the following identification: 00042512/BAAS18022/23/00042513.

This report and the biodiversity credit calculations were completed by BAM Accredited Assessor Dr Kate Hammill (BAAS18022) following the Stage 1 operational manual (DPIE 2020) and in the BAM-C version Version: 1.4.0.00, BAM data last updated 23/06/2023 (version 61).

Revision 0 of the BAM calculations was finalised on 29.10.2023 and submitted to Lithgow City Council on 31.10.2023.

Revision 1 of the BAM calculations following critical review by DPE was finalised on 5.12.2023 and submitted to Lithgow City Council on 6.12.2023.

1.10 Assessor qualifications

The qualifications and experience of the Accredited Assessor and other ecologists implementing the assessment are summarised in Table 1-2.

Table 1-2. Summary of consultant qualifications.

Name	Role	Qualifications / experience
Dr Kate Hammill, BAM Accredited Assessor	Vegetation integrity survey Targeted threatened flora survey Fauna habitat assessment and Gang-gang Cockatoo survey GIS mapping BAMC calculations Report writing.	20 years ecological research and consulting experience in NSW and practising member of the NSW Ecological Consultants Association. Biodiversity Assessment Methodology (BAM) Accredited Assessor (BAAS18022). Bushfire Planning and Design (BPAD) NSW level 2 Accredited Practitioner. Tertiary Qualifications: PhD (USyd) 2001, BSc Honours (USyd) 1996, Grad. Dip. Bushfire Protection (WSU) 2015.
Dr Meredith Brainwood Fauna Ecologist	Targeted surveys for threatened fauna candidate species	20 years experience in government, commercial and educational sectors of the environmental industry. Meredith specialises in the design and implementation of ecological restoration projects, mapping of ecosystem components and liaison with government, non-government, and private sector organisations. Doctor of Philosophy (Eco-hydromorphology), University of Western Sydney, 2007 Master of Science (Honours – Integrated Catchment Management), University of Western Sydney, 2003 Bachelor of Applied Science (Environmental Science), Charles Sturt University – Mitchell, 1995 Cert IV in Training and Assessment, Australian Training College, Kilmore, Vic, Certificate III in Rangeland Conservation (Conservation Earthworks), Orange TAFE, 2009

Name	Role	Qualifications / experience
Anne Carey Fauna Ecologist	Targeted surveys for threatened fauna candidate species	Anne has over 25 years industry experience and has extensive report writing, project management, contracts management and field experience with an excellent understanding of ecology and aquatic and terrestrial flora and fauna. Master of Wildlife Habitat Management, Macquarie University GIS post graduate certificate, University North Dakota Bachelor of Science (Conservation Biology), Macquarie University AusRivas accreditation, University of Canberra

1.11 Methods overview

Survey effort

A summary of the survey effort for the vegetation integrity assessment, fauna habitat assessment, candidate species credit species is provided in Table 1-3.

The vegetation plots and zones and threatened species survey locations and coverage are mapped in Figure 1-7.

Table 1-3. Summary of survey dates, methods and target species.

Date/s	Survey method	Survey effort	Target species
04/08/2023	Vegetation Integrity assessment	6 hours	BAM plots, fauna habitat survey
17/08/2023 & 21/08/2023	Observation, hollow watching during afternoon and dusk	2pp x 2h x 2 days (8 person hours)	Glossy Black-cockatoo, Koala
17/08/2023 & 21/08/2023	Call playback, thermal monocular and spot lighting after sunset	2pp x 1h x 2 days (4 person hours)	Powerful Owl, Barking Owl, Masked Owl, Koala
03/10/2023 & 10/10/2023	Observation, hollow watching early morning	1pp x 2h x 2d (4 person hours)	Gang-gang Cockatoo
29/09/2023 & 03/10/2023	Threatened flora transects & habitat assessment	1pp x 2h x 2d (4 person hours)	*Asterolasia buxifolia Eucalyptus pulverulenta, Eucalyptus aggregata, Leucochrysum albicans subsp. tricolor, Thesium australe*

Weather conditions

Weather conditions for the Glossy Black-cockatoo and threatened owl surveys were overall quite good with cool, still and clear conditions. Cloud increased on the afternoon of 17/8/23 and light rain fell later in the evening (post survey).

Weather conditions for the Gang-gang Cockatoo survey were generally good with cool clear and moderately windy conditions on the morning of 3/10/23 and cool and calm conditions on the morning of 10/10/23.

The Bureau of Meteorology weather data for Lithgow (Cooerwull, station 063226) during the survey months is provided below with survey dates highlighted (Figure 1-8).

Figure 1-7. Vegetation assessment and threatened species survey.

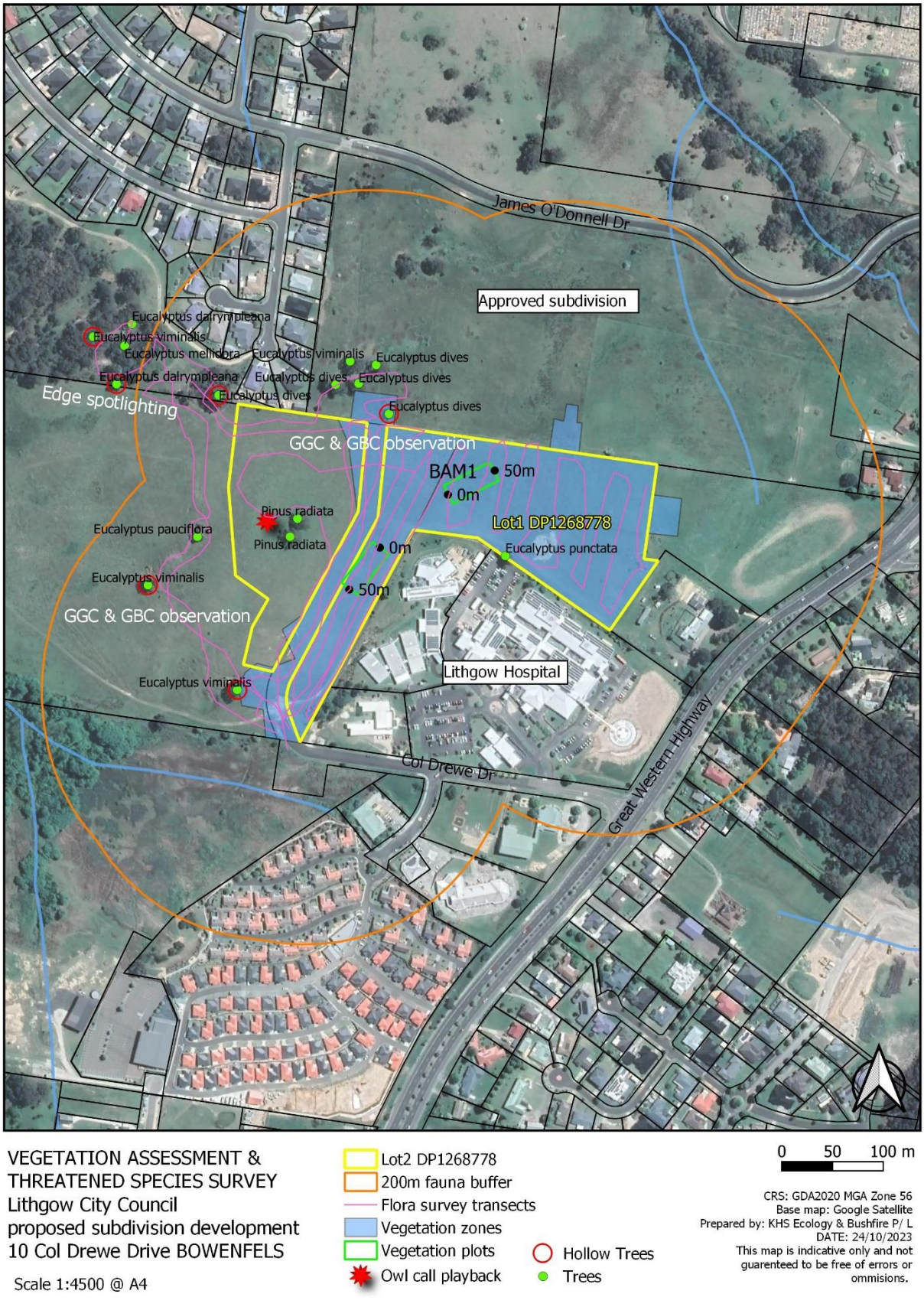


Figure 1-8. Weather conditions during the survey period (August-October 2023) with survey days highlighted (Source: Bureau of Meterology).

Lithgow, New South Wales
August 2023 Daily Weather Observations

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9 am						3 pm					
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	8th		km/h	hPa	°C	%	8th		km/h	hPa
1	Tu	3.0	15.9	0						7.2	77	0	W	4							
2	We	0.7	14.6	0.2						9.5	87	7	E	4							
3	Th	2.5	17.2	0						7.5	95	1	Calm								
4	Fr	-1.7	17.1	0						6.1	93	3	Calm								
5	Sa	6.2	13.4	0						10.9	62	8	NW	6							
6	Su	-3.5	12.5	0.4						8.4	88	8	E	6							
7	Mo	1.6	13.3	0						5.3	99	1	N	2							
8	Tu	2.1	14.5	0						7.7	89	2	Calm								
9	We	0.6	15.5	0						5.0	99	1	Calm								
10	Th	5.1	15.2	0						12.0	65	1	WNW	13							
11	Fr	-2.9	14.9	0						5.0	85	0	Calm								
12	Sa	0.0	14.9	0						8.6	67	2	SW	9							
13	Su	3.8	11.6	1.4						6.9	95	8	N	6							
14	Mo	7.0	11.9	17.2						9.9	84	4	W	9							
15	Tu	5.0		8.2						7.4	90	5	SE	4							
16	We		13.5							6.3	80		Calm								
17	Th	-1.5	15.2	0						9.0	50	2	NW	7							
18	Fr	6.5	8.3	11.4						6.6	83	6	W	11							
19	Sa	2.3	9.2	2.0						4.0	75	6	W	22							
20	Su	4.0	14.0	0						8.8	83	6	W	4							
21	Mo	-1.2	16.2	0						6.9	90	2	SW	2							
22	Tu	0.2	18.6	0						11.0	75	5	NW	4							
23	We	5.0	14.8	0						6.8	82	6	SW	7							
24	Th	2.6	15.6	0						9.3	78	5	N	6							
25	Fr	-1.6	18.7	0						8.9	82	0	Calm								
26	Sa	-1.7	16.9	0						7.8	71	2	Calm								
27	Su	2.4	16.9	0						7.6	96		NW	6							
28	Mo	0.7	18.2	0						9.9	80	2	Calm								
29	Tu	0.3	18.2	1.4						11.5	73	2	N	6							
30	We	2.2	19.2	0						13.0	77	3	NW	7							
31	Th	1.9	14.7	6.6						9.2	86	1	SW	7							
Statistics for August 2023																					
Mean		1.7	15.0							8.2	81	3		4							
Lowest		-3.5	8.3	0						4.0	50	0	Calm								
Highest		7.0	19.2	17.2						13.0	99	8	W	22							
Total				48.8																	

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Lithgow, New South Wales
September 2023 Daily Weather Observations

Date	Day	Temps Min	Temps Max	Rain	Evap	Sun	Max wind gust Dir	Max wind gust Spd	Max wind gust Time	9 am Temp	9 am RH	9 am Cld	9 am Dir	9 am Spd	9 am MSLP	3 pm Temp	3 pm RH	3 pm Cld	3 pm Dir	3 pm Spd	3 pm MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	8th		km/h	hPa	°C	%	8th		km/h	hPa
1	Fr	2.4	15.2	0						8.2	85	1	SW	6							
2	Sa	-2.0	15.7	0						6.9	77	0	SW	6							
3	Su	0.3	17.5	0						8.2	88	2	Calm								
4	Mo	0.4	20.4	0						10.3	84	1	NW	6							
5	Tu	6.3	14.9	0.2						10.9	80	3	NW	15							
6	We	-0.5	19.0	0						11.2	76	0	Calm								
7	Th	-1.7	22.5	0						15.6	71	0	NW	9							
8	Fr	6.3	10.6	13.2						6.6	95	7	NW	9							
9	Sa	2.5	9.5	3.4						4.6	87	1	SW	7							
10	Su	-5.1	12.9	0						4.9	82	0	Calm								
11	Mo	-3.0	16.0	0						8.4	79	0	W	4							
12	Tu	-0.7	17.2	0						10.7	76	3	SW	6							
13	We	-1.4	19.7	0						11.0	81	0	SW	6							
14	Th	1.0	22.2	0						14.2	77	1	Calm								
15	Fr	2.3	23.3	0						18.4	60	6	NNW	11							
16	Sa	5.2	24.6	0						19.5	67	0	NW	11							
17	Su	11.6	24.1	0						19.2	63	0	NW	9							
18	Mo	3.5	27.0	0						21.2	64	0	NNW	19							
19	Tu	4.7	26.7	0						20.9	65	0	NW	15							
20	We	15.4	25.7	0						20.1	68	0	N	22							
21	Th	8.7	16.4	0						11.6	78	0	SW	7							
22	Fr	5.5	14.0	0.6						8.5	85	6	SE	9							
23	Sa	-1.6	16.8	0						10.1	82	1	SE	7							
24	Su	2.3	19.4	0						10.8	78	1	E	7							
25	Mo	0.9	20.9	0						16.9	53	0	NW	7							
26	Tu	3.3	21.5	0						14.5	67	7	Calm								
27	We	5.4	20.9	3.8						15.9	66	2	NW	4							
28	Th	8.6	21.1	0						12.8	81	7	E	4							
29	Fr	2.4	23.1	0						19.2	37	1	NW	4							
30	Sa	0.5	24.9	0						19.4	45	0	NNW	11							
Statistics for September 2023																					
Mean		2.8	19.5							13.0	73	1		7							
Lowest		-5.1	9.5	0						4.6	37	0	Calm								
Highest		15.4	27.0	13.2						21.2	95	7	N	22							
Total				21.2																	

IDCJDW2075.202309 Prepared at 13:00 UTC on Saturday 21 October 2023

Lithgow, New South Wales
October 2023 Daily Weather Observations

Date	Day	Temps Min	Temps Max	Rain	Evap	Sun	Max wind gust Dir	Max wind gust Spd	Max wind gust Time	9 am Temp	9 am RH	9 am Cld	9 am Dir	9 am Spd	9 am MSLP	3 pm Temp	3 pm RH	3 pm Cld	3 pm Dir	3 pm Spd	3 pm MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	8th		km/h	hPa	°C	%	8th		km/h	hPa
1	Su	7.0	27.8	0						18.7	62	6	NNW	11							
2	Mo	10.2	27.4	0						14.5	76	2	E	4							
3	Tu	14.6	27.9	0						22.0	58	3	NNW	20							
4	We	17.6	17.6	0						17.6	72	8	N	15							
5	Th	5.5	12.3	32.6						6.8	83	3	W	20							
6	Fr	1.5	17.3	0						8.8	83	1	SW	9							
7	Sa	5.5	15.2	0						8.2	79	1	SE	4							
8	Su	3.9	18.4	0						9.9	82	6	NE	6							
9	Mo	2.0	19.9	0						12.5	75	0	NNW	9							
10	Tu	1.5	21.0	0						12.8	75	6	Calm								
11	We	8.9	21.6	0						13.4	84	3	N	6							
12	Th	3.0	25.3	0						17.6	65	3	N	9							
13	Fr	5.2	16.0	1.2						7.0	85	3	W	9							
14	Sa	7.0	18.7	0						10.1	86	7	NW	9							
15	Su	8.2	21.4	0						12.7	81	1	SW	7							
16	Mo	7.9	16.6	0						12.3	84	4	W	9							
17	Tu	2.3	13.5	1.6						7.2	84	7	S	11							
18	We	3.1	16.4	1.0						9.4	92	7	SE	6							
19	Th	8.6	22.6	0						10.8	86	8	N	6							
20	Fr	3.8	24.6	0						16.4	74	1	N	6							
21	Sa	5.4	27.7	0						18.5	73	1	Calm								
22	Su	9.9	20.7	0						15.6	79	1	W	13							
23	Mo	5.3	21.0	0						10.9	82	2	SW	7							
24	Tu	0.9	27.7	0						16.0	67	1	NNW	13							
25	We	10.6	22.4	0						15.1	73	2	W	9							
26	Th	2.5		0						7.7	75	7	SE	9							
Statistics for the first 26 days of October 2023																					
Mean		6.2	20.8							12.8	77	3		8							
Lowest		0.9	12.3	0						6.8	58	0	Calm								
Highest		17.6	27.9	32.6						22.0	92	8	#	20							
Total				36.4																	

IDCJDW2075.202310 Prepared at 00:36 UTC on Thursday 26 October 2023

Vegetation assessment

The identification and mapping of PCTs on the subject land has been undertaken in accordance with section 4.2 of the BAM. On disturbed or cleared sites, the plant community type (PCT) is identified to represent the forest or woodland vegetation that would have been present prior to historical clearing. This approach has been applied here, where the nearby trees in remnant patches of forest have been used to inform the decision on the prior PCT that would have occurred on the subject land that is now a derived grassland.

The vegetation integrity survey and PCT identification was undertaken according to the BAM as outlined below:

- An initial assessment of the subject land and immediate surrounds to identify tree and ground cover species to enable identification of plant community types (PCTs) and vegetation condition across the site. The data and observations were used to map vegetation zones across the site. The vegetation zone mapping and VI plot locations are detailed in **section 3**.
- Vegetation Integrity (VI) survey undertaken by a BAM Accredited ecologist on 4/8/23. Plots were located randomly within each vegetation zone with replication determined by the zone areas as per the BAM. In this case, two VI plots were surveyed which achieves the required minimum number of plots for the size of the vegetation zones (refer to **section 4**). Vegetation Integrity (VI) plots comprised a 20 m x 20 m floristic plot nested within a larger 50 m x 20 m habitat plot, and five 1 m x 1 m litter plots located at intervals 5, 15, 25, 35, 45m along the centreline of the habitat plot.

Floristic and habitat data was recorded on field data sheets and later transferred to excel spreadsheets for entry into the BAM-C.

The location of VI plot was recorded using a GPS-enabled device (Samsung S20) in the Back Country Navigator app and/or a Garmin GPS, assigned to the GDA 2020 Zone 56 projected coordinate system.

Plant species nomenclature and identification followed the keys and descriptions on NSW Flora Online (http://plantnet.rbgsyd.nsw.gov.au/). Where possible, plant species were identified in the field. Those that could not be identified were collected and identified at a later date with reference to PlantNet.

Threatened flora survey

Targeted threatened flora searches were undertaken on 29th September and 3rd October 2023, in Spring, using pedestrian transects providing full coverage of the site at a spacing of 10 m. The transect spacing was considered adequate to detect the target shrub and trees species in open grassland vegetation. The focus species for the survey were the relevant species credit species, *Asterolasia buxifolia* and *Eucalyptus pulverulenta* as well as flowering forbs and other groundcover species.

Threatened fauna survey

Glossy Black-cockatoo *Calyptorhynchus lathami* surveys were undertaken on the 17/8/23 and 21/8/23. This involved active watching for Glossy-black Cockatoos returning to the site to roost in nearby trees from 1630h to dusk. Observations were made of whole of site from a hill top observation point providing clear sight lines to the subject trees from most directions. Two ecologists observed birds flying into and around the site using binoculars. Closer observations were made pre-dusk by walking slowly

in a northward direction towards the patch of trees to the north of the site. Refer to the report attached at Appendix C.

Threatened Owl call play-back surveys were undertaken just after dark on 17/8/23 and 21/8/23, between 1845h-1930h. Target species were Powerful Owl *Ninox strenua*, Barking Owl *Ninox connivens*, Australian Masked Owl *Tyto novaehollandiae.* The calls of each target species were played intermittently for 5 minutes, followed by a 10-minute listening period (total 15 mins per species). After all the calls were played, another 10-15 minutes of listening along with searches with a thermal monocular (Hikmicro Falcon 35) were undertaken. Observers scanned the sky for approaching owls from the vantage point of the hill crest. The area was also swept with spotlights to check for birds that may have been attracted by the calls but were not vocalising. Refer to the report attached at Appendix C.

Gang -gang Cockatoo survey of hollow-bearing trees within a 200m buffer of the development site was undertaken in the early mornings of 3rd October and 10th October, within the required timing for detecting Gang-gang Cockatoos breeding activity. A reference observation was made by KHS Ecology & Bushfire ecologists of a group of Gang-gang Cockatoo around a hollow tree in the Hassans Walls Reserve in late September, indicating there was breeding activity in the local area around the time of the survey.

The subject land contains one Koala use tree *Eucalyptus dives* in the north and a second Koala use tree *Eucalyptus viminalis* at the development boundary in the south of the subject land. The survey for Koala comprised spotlighting as part of the Glossy Black-cockatoo and threatened owl surveys in August, followed by searches for Koala scats under the two Koala use trees in September.

Other candidate threatened fauna species have been assessed based on habitat and ruled out based on degraded habitat or absence of habitat constraints, as described for each species in section 4.

2 Landscape context

2.1 Bioregion and landscape

The subject site is located at an elevation of between 960 m and 940 m above sea level, and within the Bathurst subregion of the South Eastern Highlands IBRA bioregion. The Bathurst subregion is generally characterised by the following features.

> Landform: Rounded hills in a granite basin surrounded by stepp slopes on the contrast margin. Outcrops with tors near margins. Chain of pond streams in wide flat valley floors, Terrace alluvium along the Macquarie River (NPWS 2008).
>
> Soils: Shallow red earths on ridges, yellow textured contrast soils on all slopes and deep coarse sands in alluvium (NPWS 2008).
>
> Vegetation: Apple box, yellow box, some white box and red stringybark. Ribbon gums on lower slopes and brown barrel in the east. Patches of black cypress pine in rocky outcrop areas. River oak along streams (NPWS 2008).

The subject land is located at the junction of the Bathurst Granites and Sydney Basin Western Escarpment Mitchell Landscapes. The site landscape is most consistent with Bathurst Granites landscape description and this has been used in the BAM-C- refer to descriptions below

The Bathurst Granites landscape consists of the following characteristics (DECC 2002).

> *Undulating to steep hills on Carboniferous granites and granodiorite. Tors and rock outcrop common on the margins of the pluton that is surrounded by a distinctive contact ridge with steep slopes, general elevation 650 to 1000m, local relief 250m. Shallow red earths or siliceous sands occur on ridges, gritty texture-contrast soils with yellow clay subsoils on the slopes with deep coarse sands along streamlines and dense black clays in small swamps. Woodland to open forest of; yellow box (Eucalyptus melliodora), broad-leaved peppermint (Eucalyptus dives), red stringybark (Eucalyptus macrorhyncha) and white box (Eucalyptus albens) on ridges and slopes, manna gum (Eucalyptus viminalis) and river oak (Casuarina cunninghamiana) in valleys. Patches of black cypress pine (Callitris endlicheri) in rocky outcrops, grasslands with patchy snow gum (Eucalyptus pauciflora) woodlands in cold air drainage hollows.*

The Sydney Basin Western Escarpment is described as follows (DECC 2002).

> *Steep dissected slopes on the western margin of the Triassic rocks and descending into the Permian conglomerate, shale and sandstone. Cliffs and gorges to 100m, general elevation 250 to 1000m, local relief 150m. Brown loamy sands in rubbly soil on debris slopes, with deeper accumulations toward the valley floor. Dry aspects; open forest of Sydney peppermint (Eucalyptus piperita), smooth-barked apple (Angophora costata), grey gum (Eucalyptus punctata), broad-leaved ironbark (Eucalyptus fibrosa ssp. fibrosa) and rough-barked apple (Angophora floribunda). Moist aspects; tall open forest of round-leaved gum (Eucalyptus deanei), turpentine (Syncarpia glomulifera), Sydney blue gum (Eucalyptus saligna), blue-leaved stringybark (Eucalyptus agglomerata), thin-leaved stringybark (Eucalyptus eugenioides) and narrow-leaved ironbark (Eucalyptus crebra). Coachwood (Ceratopetalum apetalum) and sassafras (Doryphora sassafras) in the gullies.*

2.2 Geology and soil

The subject land has fine to textured and occasional small granite rock to the west of the site, consistent with Bathurst Granites landscape.

2.3 Rivers, streams and estuaries

The subject land does not contain any mapped watercourses (refer to site map in **Figure 1-2**). The nearest mapped watercourse is a first order tributary of the Cox's River, located approximately 60m to the south of the site, flowing towards the west. This watercourse is associated with a large expanse of apparent wetland with *Phragmites australis* (Common Reed), indicated as a wetland in **Figure 1-2**. The Cox's River itself is located some 1600m to the northwest.

2.4 Native vegetation cover

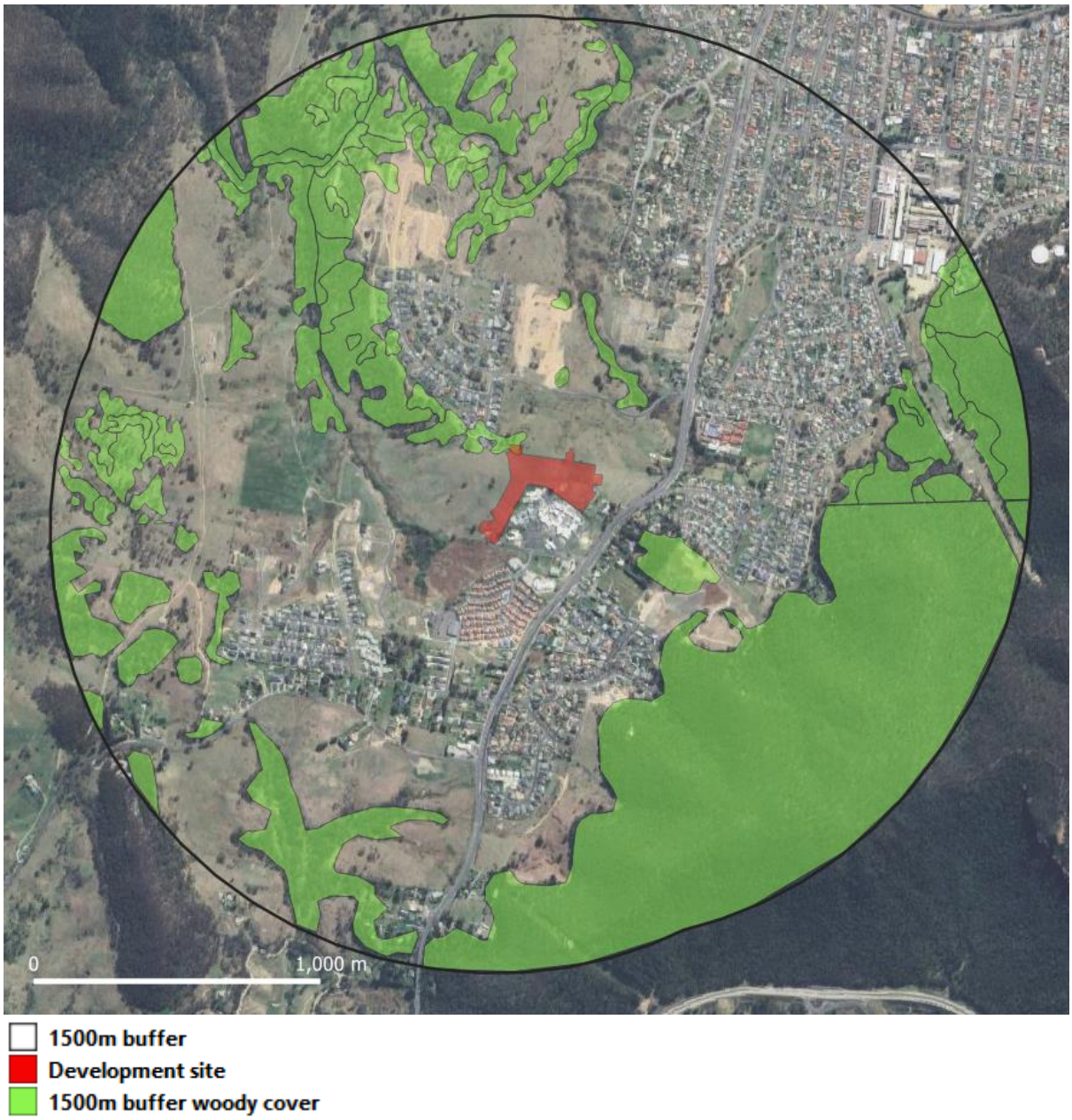
Native vegetation extent was assessed within a 1500 m buffer around the development site by a combination of on-site verification and desktop mapping including interpretation of aerial imagery in GIS.

The extent of native vegetation in the 1500m buffer area is summarised in **Table 2-1** and mapped **Figure 2- 1**. The relevant cover class used in the BAM is >10-30% of native vegetation.

Table 2-1. Extent of native vegetation in the study area.

Total area of 1500m buffer	Total area of native vegetation within the buffer (ha)	Native vegetation cover in 1500 m buffer
899 ha	306.3 ha	34%

Figure 2-1. Native vegetation cover within the 1500m buffer.



2.5 Connectivity

The subject site has limited habitat connectivity to native vegetation areas to the west and east due to the site itself being cleared of all woody vegetation and heavily grazed, and the surrounding development being a deterrent for many native fauna, i.e. there is the Lithgow Hospital immediately to the east, existing residential subdivisions to the northwest, north and south.

The subject site is cleared of trees other than two large pines (*Pinus radiata*) on top of the hill. The derived grassland on the site has been grazed over a long period and has lost much of the native groundcover composition that would be expected from an intact native grassy woodland (Photograph 2-1, Photograph 2-2 and Photograph 2-3).

To the north of the subject site, outside the proposed subdivision footprint, there is a patch of trees of *Eucalyptus dives* and *Eucalyptus mellidora* which provide some habitat values for biodiversity. The land containing these trees (Lot 2 DP 1049398) has an existing approval for a subdivision and is therefore considered 'impacted' land already approved for clearing (Photograph 2-4). This area contains scattered trees of *Eucalyptus dives* and *Eucalyptus viminalis*, some of which contain hollows.

To the south of the subject site, there is large expanse of *Phragmites australis* (Common Reed), characterising a semi-natural wetland area (also containing Blackberry, Hawthorn trees and other weeds). This area was observed to be used by a diversity of woodland birds during the surveys for this study. The reed thickets and small trees in this area represent habitat values that are not present on the subject land, and contribute to biodiversity values and habitat connectivity surround the site (Photograph 2-5).

Hassans Walls reserve is situated at a distance of 500-800 m east of the subject land and contains large expanses of bushland and the sandstone escarpment landscape. This reserve is separated from the subject land by residential areas, the Great Western Highway and Lithgow Hospital, which collectively is a substantial barrier and impediment to movement of wildlife from Hassans Walls to the site, other than highly mobile/flying species such as birds and bats (Photograph 2-6).

To the west of the subject site, the land next to the subdivision on Lot 1 DP 1268778 rises to the crest of a hill with the large pines (*Pinus radiata*) and then falls towards the creek gully leading to the Cox's River. The forested areas to the west (shown in Photograph 2-7) are separated from the subject land by cleared paddock and the hill. Council proposes to reserve this portion of Lot 1 DP 1268778 as open space, consistent with the objectives of the C3 Environmental Management zoning (refer to Figure 1-1 and Figure 1-2). These areas to be retained as open space will provide connectivity of fauna habitat through the local area, including connecting to the creek corridor and forest areas leading to the Cox's River further west.

Photograph 2-1. Entry to the subject site on Col Drewe Drive, the proposed subdivision is limited to the lower part of the hill in this view (below the dashed line, approximately).

Photograph 2-2. The southern part of the subject site, adjoining the Lithgow Hospital (at right) showing derived grassland with few tussocks and absence of litter, logs, and rocks.

Photograph 2-3. The centre of the subject site, looking to the northeast, showing grazing impact and low groundcover diversity.

Photograph 2-4. Land to the north of the subject site (Lot 2 DP 1049398) which already approved for a separate subdivision. Two cul-de-sacs on the northern side of the Council subdivision will be located on this land. The Eucalyptus dives tree in this view is a hollow-bearing habitat tree at risk of being impacted. An exclusion zone is recommended as described in section 5.1.

Photograph 2-5. Land to the south of the subject site where a watercourse runs through a large patch of Phragmites australis indicating a wetland. This area is not within the subject land and is separated from the subject land by retained grassland area.

Photograph 2-6. View to the east over the subject site (the subdivision will be situated downslope of the pines), looking towards Lithgow Hospital (roof visible on the left side) and the older residential areas and Hassans Walls reserve beyond.

Photograph 2-7. View to the west of the subject site, looking towards the creek gully leading to the Cox's River and Marangaroo National Park beyond. This area is within the fauna survey buffer for the current development and has been assessed by targeted survey for forest owls, Glossy Black-cockatoo and Gang Gang Cockatoo.

2.6 Areas of Outstanding Biodiversity Value

There are no declared Areas of Outstanding Biodiversity Value (AOBV) relevant to the proposal. Current AOBV listed on the register (updated as of 18/1/2022) comprise the following items, which are not relevant to the current proposal.

- Gould's Petrel – critical habitat declaration.
- Little penguin population in Sydney's North Harbour – critical habitat declaration.
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve – critical habitat declaration.
- Wollemi Pine – critical habitat declaration.

3 Native vegetation

3.1 Review of existing PCT mapping

Existing plant community type (PCT) mapping available on the SEED dataset portal (The Central Resource for Sharing and Enabling Environmental Data in NSW, accessed at https://www.seed.nsw.gov.au/ , 24/10/2023) was reviewed to ascertain previously mapped vegetation communities on and near the subject land.

An extract of the published PCT mapping is shown in **Figure 3-1**. The following PCTs are mapped on or near the subject land.

- 3226, Western Blue Mountains Montane Wet Fern Forest
- 3367, Central Tableland Granites Grassy Box Woodland
- 3369, Central Tableland Ranges Peppermint-Gum Grassy Forest
- 3376, Southern Tableland Grassy Box Woodland
- 3385, Southern Tableland Creekflat Swamp Woodland
- 3738, Goulburn-Lithgow Tableland Hills Grassy Forest

Figure 3-1. Existing mapping of PCTs (Source: https://www.seed.nsw.gov.au/, accessed 18/7/2023).

3.2 Plant species

A list of flora species recorded during the site assessments is provided in Appendix A. A total of 31 species was recorded across the site including land immediately adjoining the site (to assist with PCT identification), comprising 19 native and 12 non-native species.

The property has been historically cleared for grazing and is derived grassland with surounding scattered forest trees of *Eucalyptus dives* (Broad-leaved Peppermint), *Eucalyptus viminalis* (Ribbon gum), *Eucalyptus dalrympleana subsp. dalrympleana* (Mountain gum) and very occassional *Eucalyptus melliodora* (Yellow Box).

The groundcover across the site was mixed native and non-native species, with the native component comprised of the following species: *Austrostipa pubescens* (Tall Speargrass), *Digitaria diffusa* (Open Summer-grass), *Juncus* spp., *Microlaena stipoides* (Weeping Grass), *Panicum* spp., *Poa labillardieri* (Poa Tussock), *Rytidosperma* spp. (Wallaby Grass), *Themeda triandra* (Kangaroo Grass), *Euchiton sphaericus* (Star Cudweed), *Leucochrysum albicans* subsp*. albicans*.

3.3 Site-assessed PCTs

The best-fit PCT has been selected from a short-list of PCTs occurring in the Bathurst IBRA subregion and based on landscape position, geology, soil type and native species observed. The PCT identified for the subject land and rationale for selecting this PCT is provided below.

PCT 3348 Southern Tableland Granites Ribbon Gum Grassy Forest

Site identification: PCT 3348 is identified on the subject site based on the tree species present around (not within) the development site comprising mainly *Eucalyptus viminalis, Eucalyptus dives, Eucalyptus pauciflora,* in addition to the site being within the Cox's River at an elevation of 940-960m asl. The groundcover includes *Themeda triandra* (Kangaroo Grass) and *Poa labillardieri*, noting that Kangaroo Grass was rare on the site and only occurred in a small area in the centre of the site. PCT 3348 is assigned to the entire development site in the form of a derived grassland entirely lacking shrubs and trees, other than paddock trees on the far northern and south western edges of the subject land.

Published Description: *A tall grassy sclerophyll open forest to woodland restricted to undulating to rolling tableland landscapes on sandy soils derived from granitoid and acid volcanic substrates of moderately high and cool north-east parts of the South Eastern Highlands bioregion. This PCT has a disjunct distribution with a southern cluster from Snowball north to Durran Durra, Mount Fairy and Bungonia, central plots in the Taralga to Laggan area, and northern plots in the Coxs River catchment around Hartley and Hampton. It occurs at elevations of 550-1100 metres asl, with means of 650-1000 mm precipitation and 6-45 frost days annually. A sparse to mid-dense canopy almost always includes Eucalyptus viminalis, occasionally with Eucalyptus pauciflora and/or Eucalyptus radiata, with a sparse small tree stratum that includes occasional Acacia melanoxylon. Plots sometimes include a very sparse layer of smaller shrubs, most frequently with Bursaria spinosa. A mid-dense to dense, grassy ground layer is very frequently dominated by Microlaena stipoides, commonly with Themeda triandra, Rytidosperma racemosum and occasional Poa labillardierei var. labillardierei and/or Poa sieberiana. Other common ground layer species include Pteridium esculentum, Lomandra longifolia, Lomandra multiflora subsp. multiflora clumps, Rubus parvifolius, Dichondra repens, Acaena novae-zelandiae, Desmodium varians, Glycine clandestina, Hydrocotyle laxiflora, Lomandra filiformis, Stellaria pungens,*

Geranium solanderi and Gonocarpus tetragynus. This community is commonly replaced on footslopes and creek flats by PCT 3347. (DPE 2023a).

NSW Class / Formation (Keith 2004): Tableland Clay Grassy Woodlands / Grassy Woodlands.

Associated TEC: No.

Estimated percent cleared: 82.1%.

Photograph 3-1. Eucalyptus viminalis (Ribbon Gum) and Acacia melanoxylon in forest areas to the northwest of the development site, behind the existing houses off James O'Donnell Drive, consistent with the vegetation community PCT 3348.

Photograph 3-2. Eucalyptus dives (Broad-leaved Peppermint) trees to the north of the development site indicating PCT 3348. This area has existing approval for a subdivision by a private developer on Lot 2 DP 1049398.

Photograph 3-3. Eucalyptus pauciflora (Snow Gum) trees to the west of the development site indicating PCT 3348.

Photograph 3-4. The derived grassland groundcover contained patches of Themeda triandra (Kangaroo Grass) and Poa labillardieri indicating the site previously had a grassy woodland; these grasses are consistent with PCT 3348.

3.4 Threatened ecological communities

PCT 3348 Southern Tableland Granites Ribbon Gum Grassy Forest is not associated with a threatened ecological community TEC, as documented in the BioNet Vegetation Information System database description for the PCT.

3.5 Vegetation zones, patch size and plots

Vegetation zones and patch size were identified and mapped in accordance with section 4.3 of the BAM. Vegetation zones are based on the PCT identified on the subject land and condition of vegetation assessed on site. In this case, there is one vegetation zone as summarised below.

- Zone 1, PCT 3348 Derived Grassland, with mixed exotic and native groundcover and absence of trees and shrubs.

Patch size for the vegetation zone was using the following steps:

- Identify vegetation zones that will be included in the same patch (i.e. vegetation zones located within 100 metres of one another for intact native woody vegetation and within 30 metres of one another for intact native non-woody vegetation).
- Identify the boundary of any adjoining intact native vegetation which extends beyond the limit of the subject land.
- Digitise each patch using separate polygons where multiple patches exist.
- Calculate the area of each patch in hectares.
- Assign the patch size for each vegetation zone to a size class, <5ha, 5–24ha, 25–100ha or >100ha.

The patch size is the connected patch of same or similar vegetation type and condition and can extend beyond the subject site.

The site-assessed extent of vegetation zones and location of the vegetation plots is shown in **Figure 3-1**. Two VI plots were surveyed in this assessment in accordance with the minimum requirement for vegetation zone size of >2−5 ha.

The vegetation zones and patch size details and location of the VI plots are included in **Table 3-1** and **Table 3-2**.

Figure 3-2. Extent of PCT 3348 derived grassland zone and location of vegetation integrity plots.

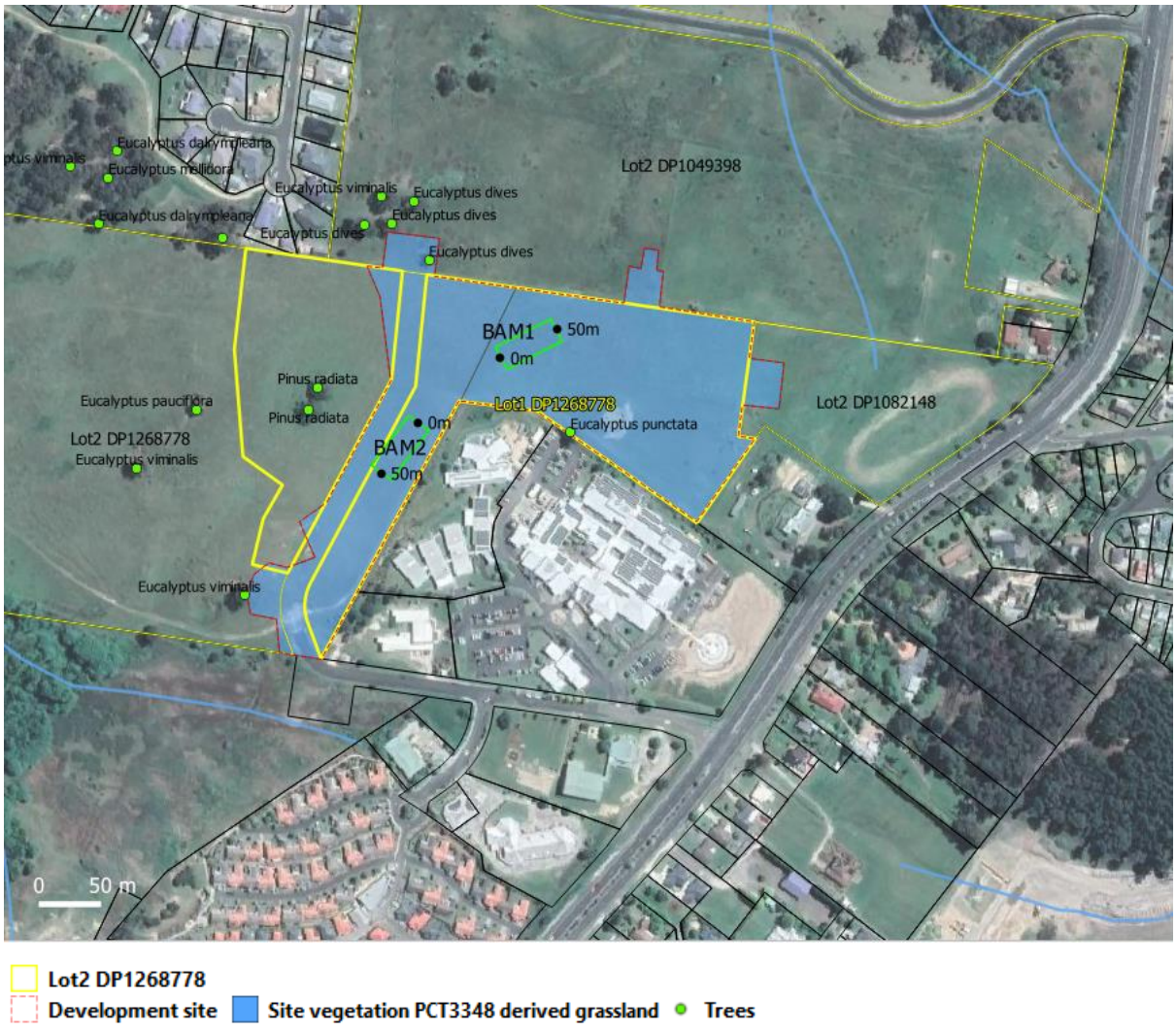


Table 3-1. Vegetation zones summary.

Vegetation zone	Zone area (ha)	Patch size (ha)	Patch size category	Minimum BAM plots required	BAM plots surveyed
PCT 3348 derived grassland	4.6 ha	55 ha	25–<100 ha	2	2

Table 3-2. Vegetation plot details.

Vegetation zone	Zone area (ha)	Plot ID	Grid Reference (0 m) GDA2020 MGA Zone 56	Plot dimensions	Centreline direction
PCT 3348 derived grassland	4.6 ha	BAM 1	233081, 6289889	20 m x 50 m	340 deg
		BAM 2	233014, 6289837	20 m x 50 m	210 deg

3.6 Vegetation integrity data

A summary of the data collected in the VI plots is shown in Table 3-3. The VI plot field data sheet and photographs are provided in Appendix B.

Table 3-3. Vegetation Integrity plot data summary: (a) count of species per growth form group, (b) cover per growth form and non-native and High Threat Weed cover and (c) function data.

(a) Count of species per growth form	BAM 1	BAM 2
Tree (TG)	0	0
Shrub (SG)	0	0
Forb (FG)	0	1
Grass & grasslike (GG)	4	6
Fern (EG)	0	0
Other (OG)	0	0
Total Native	**4**	**7**
Non-native	**10**	**4**

(b) Cover (%) per growth form	BAM 1	BAM 2
Tree (TG)	0	0
Shrub (SG)	0	0
Forb (FG)	0	0.1
Grass & grasslike (GG)	35.1	75.6
Fern (EG)	0	0
Other (OG)	0	0
Total Native	**35.1**	**75.7**
Non-native	**59.6**	**26.1**

(c) Function data	BAM 1	BAM 2
Large Trees	0	0
Hollow trees	0	0
Litter Cover (%) av. 5 plots	5.4	18
Length Fallen Logs	0	0
Tree Stem <5 cm (regeneration)	0	0
Tree Stem 5 to 9 cm	0	0
Tree Stem 10 to 19 cm	0	0
Tree Stem 20 to 29 cm	0	0
Tree Stem 30 to 49 cm	0	0
Tree Stem 50 to 79 cm	0	0
Tree Stem >80 cm	0	0
High Threat Weed cover (%)	0	0

The current and future vegetation integrity (VI) scores for the vegetation zones are provided in Table 3-4, derived in the BAM-C. The benchmark data used in this assessment consisted of the published data contained in the BAM-C.

For the one vegetation zone within the subject land, the VI score is calculated as 10.3. This score is below the threshold that creates ecosystem credits. The future VI score will be zero due to the entire site being subject to development, producing a change in VI of -10.3. The assessment and BAM calculations have resulted in zero ecosystem credits, as outlined in section 6 (biodiversity credit report).

Species credits still apply to the site, as outlined in section 4.2 (species review) and section 6 (biodiversity credit report).

Table 3-4. Current and future vegetation integrity (VI) scores for the vegetation zones.

Vegetation zone ID	Current/ Future	Composition condition score	Structure condition score	Function condition score	Vegetation integrity score	Hollow bearing trees present?
PCT 3348 derived grassland	Current	16.8	64.7	1	10.3	No
	Future (post development)	0	0	0	0	No

4 Threatened species

4.1 Ecosystem credit species

The BAM calculator identifies the following 24 ecosystem credit species relevant to the site with PCT 3348 (also summarised in Table 4-1).. These species are deemed to be reliably predicted to utilise the site due to the landscape features and vegetation community PCT 3348 Southern Tableland Granites Ribbon Gum Grassy Forest. These predicted species can only be excluded if the habitat constraints identified in the threatened species data collection are absent from the site.

- Barking Owl *Ninox connivens*
- Black Falcon *Falco subniger*
- Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoriae*
- Diamond Firetail *Stagonopleura guttata*
- Dusky Woodswallow *Artamus cyanopterus cyanopterus*
- Flame Robin *Petroica phoenicea*
- Gang-gang Cockatoo *Callocephalon fimbriatum*
- Glossy Black-Cockatoo *Calyptorhynchus lathami*
- Grey-headed Flyingfox *Pteropus poliocephalus*
- Little Eagle *Hieraaetus morphnoides*
- Little Lorikeet *Glossopsitta pusilla*
- Masked Owl *Tyto novaehollandiae*
- Powerful Owl *Ninox strenua*
- Rosenberg's Goanna *Varanus rosenbergi*
- Scarlet Robin *Petroica boodang*
- Speckled Warbler *Chthonicola sagittata"*
- Spotted Harrier *Circus assimilis*
- Spotted-tailed Quoll *Dasyurus maculatus*
- Square-tailed Kite *Lophoictinia isura*
- Swift Parrot *Lathamus discolor*
- Varied Sittella *Daphoenositta chrysoptera*
- White-bellied Sea- Eagle *Haliaeetus leucogaster*
- White-throated Needletail *Hirundapus caudacutus*

One predicted species, the Glossy Black-Cockatoo *Calyptorhynchus lathami*, has been excluded because its habitat constraints are absent from the subject land, namely 'Presence of *Allocasuarina* and casuarina species'. The site and surrounds lack a shrub and small tree layer. There are no

Allocasuarina plants on or near the site which would provide the required forage habitat for the Glossy Black-Cockatoo, hence this species is able to be excluded as a predicted species on the development site.

4.2 Species credit species

The BAM calculator predicts the following candidate species credit species at the site (also summarised in Table 4-1). These species must be assumed present unless they are adequately surveyed to confirm their absence, or it can be justified that they are not present due to their habitat constraints as defined in the threatened species data collection not being present.

- *Asterolasia buxifolia*
- *Burhinus grallarius* Bush Stone-curlew
- *Callocephalon fimbriatum* Gang-gang Cockatoo (Breeding)
- *Calyptorhynchus lathami* Glossy Black-Cockatoo (Breeding)
- *Cercartetus nanus* Eastern Pygmy-possum
- *Chalinolobus dwyeri* Large-eared Pied Bat
- *Delma impar* Striped Legless Lizard
- *Eucalyptus aggregata* Black Gum
- *Eucalyptus pulverulenta* Silver-leafed Gum
- *Haliaeetus leucogaster* White-bellied Sea-Eagle (Breeding)
- *Hieraaetus morphnoides* Little Eagle (Breeding)
- *Lathamus discolor* Swift Parrot (Breeding)
- *Leucochrysum albicans subsp. tricolor* Hoary Sunray
- *Litoria aurea* Green and Golden Bell Frog
- *Litoria booroolongensis* Booroolong Frog
- *Litoria raniformis* Southern Bell Frog
- *Lophoictinia isura* Square-tailed Kite (Breeding)
- *Miniopterus orianae oceanensis* Large Bent-winged Bat (Breeding)
- *Mixophyes balbus* Stuttering Frog
- *Ninox connivens* Barking Owl (Breeding)
- *Ninox strenua* Powerful Owl (Breeding)
- *Paralucia spinifera* Purple Copper Butterfly, Bathurst Copper Butterfly
- *Petauroides volans* Southern Greater Glider
- *Petrogale penicillata* Brush-tailed Rock-wallaby
- *Phascogale tapoatafa* Brush-tailed Phascogale

- *Phascolarctos cinereus* Koala
- *Pteropus poliocephalus* Grey-headed Flying-fox (Breeding)
- *Thesium australe* Austral Toadflax
- *Tyto novaehollandiae* Masked Owl (Breeding)

A habitat suitability assessment has been undertaken for these species and is discussed for each species below. The habitat suitability follows the requirement of section 5 of the BAM and considers whether suitable habitat is present on the subject land, or within the relevant buffer distance (as defined for the species in the threatened biodiversity data collection) around the subject land. This includes assessment as to whether features required for survival and life cycles such as vegetation complexity, flowering shrubs, or permanents streams, water bodies and riparian habitat are present or not. For species predicted for breeding (Gang-gang Cockatoo, Glossy Black-Cockatoo, White-bellied Sea-Eagle, Little Eagle, Swift Parrot, Square-tailed Kite, Large Bent-winged Bat, Barking Owl, Powerful Owl, Masked Owl, Grey-headed Flying-fox), the assessment has determined whether specific breeding habitat is present on or around the subject land as defined in the TBDC.

The following candidate species have been assessed as not having suitable habitat present on the subject land, including if the habitat is degraded, and have been excluded as species credits.

- *Litoria booroolongensis* Booroolong Frog –This species relies on permanent streams and adjacent vegetation cover and leaf litter. There are no permanent streams or riparian vegetation along watercourses on the site. The land is cleared throughout and heavily grazed with almost no leaf litter cover. This species is excluded based on habitat degraded.
- *Litoria raniformis* Southern Bell Frog – There are no permanent ponds or flowing chain of ponds or vegetation watercourse lines occur on the site. This species relies on permanent flowing water which is not present on the subject land. The land is cleared throughout and heavily grazed with no litter cover. This species is excluded based on degraded habitat.
- *Mixophyes balbus* Stuttering Frog – This species is found in rainforest and wet, tall open forest and breeds in streams during summer after heavy rain. Outside the breeding season, adults live in deep leaf litter and thick understorey vegetation on the forest floor. There are no permanent streams or vegetation along watercourses on the site, nor any thick vegetation cover and leaf litter. The land is cleared throughout and heavily grazed with almost no leaf litter cover. This species is excluded based on habitat degraded.
- *Litoria aurea* Green and Golden Bell Frog – The subject land has a small depression / dam about 10m across that sometime contains water. At the time of the habitat assessment in late September, this depression was dry and unsuitable any amphibians to be present and active. The depression lacks aquatic vegetation, comprising only a few tussocks of *Juncus* amongst heavily trampled soil, and lacks the aquatic vegetation preferred by this species containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.) (Photograph 4-1). Based on the conditions at the time of the habitat assessment, the small dam / depression appears unsuitable for the Green and Golden Bell Frog and is unlikely to support any individuals or a population of these frogs. This species is excluded based on habitat degraded.
- *Phascogale tapoatafa* Brush-tailed Phascogale – There are no trees or native shrubs present on the development site and a lack of diverse native groundcover vegetation. This species relies

on complex open forest habitat with groundcover of herbs, grasses, shrubs or leaf litter. Given the site is cleared and heavily grazed and lacking in logs, litter and vegetation layers the habitat is considered to be degraded and unsuitable for this species.

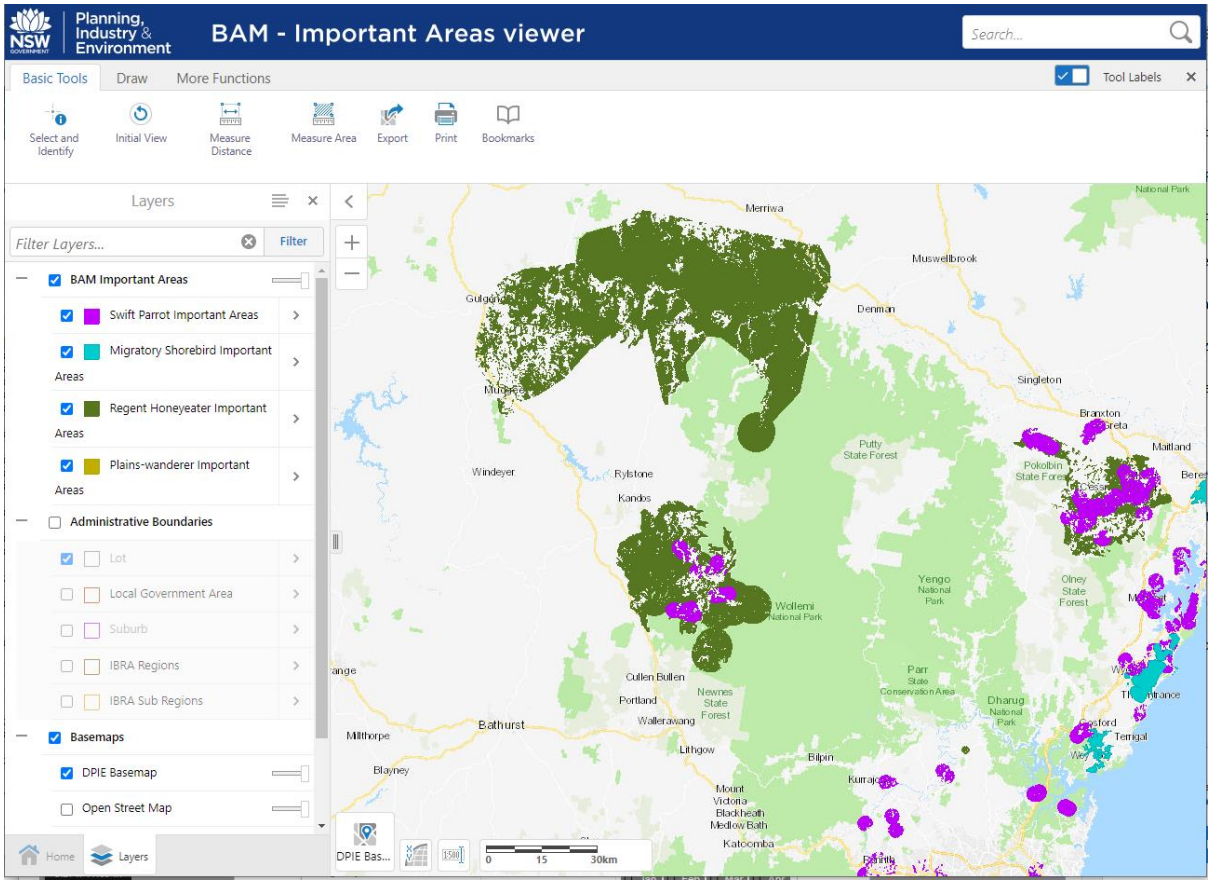
- *Petrogale penicillata* Brush-tailed Rock-wallaby – The site is located within the 1km of forests and rocky areas with the Hassans Walls reserve, however there is intensive residential development and a major highway (the Great Western Highway) between this potential habitat and the subject land. There are no recent records for the Brush-tailed Rock-wallaby in Hassans Walls reserve. Even if present in Hassans Walls, the Brush-tailed Rock-wallaby is a shy species that would not traverse highly developed areas to access the subject land. This species has been assumed absent due to habitat degradation.
- *Burhinus grallarius* Bush Stone-curlew – This species requires complex groundcover with logs and litter. The land is cleared throughout and heavily grazed with almost no leaf litter cover. This species has been ruled out due to the absence of habitat constraint Fallen/standing dead timber including logs'.
- *Cercartetus nanus* Eastern Pygmy-possum – Foraging habitat is not present on the site due to the lack of shrubs and nectar producing plants (i.e. there are no shrubs or logs or stumps and no banksia shrubs or bottlebrushes etc.). This species has been assumed absent due to habitat degradation.
- *Pteropus poliocephalus* Grey-headed Flying-fox (Breeding) – This species forms large camps and breeding colonies, typically in trees in gullies or rive corridors. The site was surveyed and no breeding camps were observed to be present on the subject land or adjacent forests or stands of trees. This species has been ruled out based on absence of breeding sites.
- *Miniopterus orianae oceanensis* Large Bent-winged Bat (Breeding) – There are no caves or cliffs within 200m of the site, which is the breeding habitat for this species. The nearest cliffs and potential caves are located in the Hassans Walls reserve approximately 1km to the east of the subject land. This species has been excluded as a credit species based on habitat constraints for breeding.
- *Hieraaetus morphnoides* Little Eagle (Breeding) – Breeding habitat is live (occasionally dead) large old trees within suitable vegetation and the presence of a male and female; or any adult with nesting material; or an individual on a large stick nest in the top half of the tree canopy; or pairs displaying (soaring, diving, engaging in chases, or a male observed calling in flight with a female begging from tree). Paddock trees can provide important breeding habitat. The subject land and a buffer of approximately 300m around the site was assessed for potential nests in trees and presence of birds of Little Eagle. No nest trees were found. The species has been ruled out for breeding based on the absence of nest trees.
- *Paralucia spinifera* Purple Copper Butterfly, Bathurst Copper Butterfly – Larvae of the Purple Copper Butterfly feed exclusively on *Bursaria spinosa subsp. lasiophylla*, however because this subspecies is very difficult to identify the habitat constraint has been expanded to include all *Bursaria spinosa* types (subspecies). Adults are known to forage on other flowering native species up to 40 m from *Bursaria* plants. The subject land and surrounds to at least 40m were searched during the vegetation and fauna surveys looking specifically for any Bursaria plants.

No plants of Bursaria were found. Based on the habitat constraint 'Bursaria spinosa or within 40m of Bursaria spinosa' being absent, this species is ruled out as a species credit.

- *Petauroides volans* Southern Greater Glider – The species is allocated to species credit because it occurs across a broad range of vegetation types and can be reliably detected from survey. The subject land does not contain forest or stands of trees that would provide habitat for this species. The TBDC states that paddock trees are not important habitat. While there may be suitable habitat nearby, including in Hassan Walls reserve and in the gully to the west of the site, the lack of trees on the subject land means the development will not impact habitat for this species. Further the subject land would not provide a movement corridor given the lack of connectivity due to existing surrounding development which is greater than 100m in width i.e there are no suitable glide path between forest patches. The species has been ruled out due to lack of trees and habitat degraded.
- *Lophoictinia isura* Square-tailed Kite (Breeding) – Breeding habitat is live large old trees within suitable vegetation and the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy. The subject land and a buffer of approximately 300m around the site was assessed for potential nests in trees and presence of birds of Square-tailed Kite. No nest trees were found. The species has been ruled out for breeding based on the absence of nest trees.
- *Delma impar* Striped Legless Lizard – Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass *Themeda australis*, spear-grasses *Austrostipa* spp. and poa tussocks *Poa* spp., and occasionally wallaby grasses *Austrodanthonia* spp. Sometimes present in modified grasslands with a significant content of exotic grasses. Goes below ground or under rocks or logs over winter. This species relies on grass tussocks. Given the site is cleared and heavily grazed and largely lacking tussocks the habitat is considered to be degraded and unsuitable for this species. The species has been ruled out based on habitat degraded.
- *Lathamus discolor* Swift Parrot (Breeding) – No survey required. The species is assessed for species credits via the Important Habitat Map. The species is considered not present due to the subject land not being within the areas on the important habitat map (Figure 4-1).

Photograph 4-1. The dam on the eastern part of the site on 12/10/2023, looking to the east, showing the lack of water, minimal wetland vegetation and impact of cattle.

Figure 4-1. Important areas map for Swift Parrot, Regent Honeyeater and Plains Wanderer, with the development site location indicated by the red box, at Lithgow.



The following species are considered to have suitable habitat on the subject land and/or have been assessed by targeted survey.

- *Callocephalon fimbriatum* Gang-gang Cockatoo – A survey of hollow-bearing trees within a 200m buffer of the development site was undertaken in the early mornings of 3rd October and 10th October, within the breeding season. Based on an observation of a breeding group Gang-gang Cockatoo around a hollow tree in the Hassans Walls Reserve in late September, there is confidence in the current survey effort in early October in detecting any breeding activity if present on or around the development site. No Gang-gang Cockatoos were observed during the surveys. The species credit for Koala have ruled out by survey.
- *Phascolarctos cinereus* Koala – The subject land contains one Koala use tree *Eucalyptus dives* in the north and a second Koala use tree *Eucalyptus viminalis* at the development boundary in the south of the subject land. The survey for Koala comprised spotlighting as part of the Glossy Black-cockatoo and threatened owl surveys in August, followed by searches for Koala scats under the two Koala use trees in September. Based on the combined spotlighting and scat surveys and otherwise lack of Koala use trees on the remainder of the site, the presence of Koala is considered highly unlikely. The species credit for Koala have ruled out by survey.
- *Ninox connivens* Barking Owl (Breeding) – Threatened owl call play-back surveys were undertaken just after dark on 17th August and 21st August as well as spotlighting along the treed areas and paddock trees around the site. This survey timing is within the breeding season of the species defined in the TBDC. No Barking Owl response calls or sightings were made (refer to Appendix D). The species credits for Barking Owl (breeding) have ruled out by survey.
- *Ninox strenua* Powerful Owl (Breeding) – Threatened owl call play-back surveys were undertaken just after dark on 17th August and 21st August as well as spotlighting along the treed areas and paddock trees around the site. This survey timing is within the breeding season of the species defined in the TBDC. No Powerful Owl response calls or sightings were made (refer to Appendix D). The species credits for Powerful Owl (breeding) have ruled out by survey.
- *Tyto novaehollandiae* Masked Owl (Breeding) – Threatened owl call play-back surveys were undertaken just after dark on 17th August and 21st August as well as spotlighting along the treed areas and paddock trees around the site. This survey timing is within the breeding season of the species defined in the TBDC. No Masked Owl response calls or sightings were made (refer to Appendix D). The species credits for Masked Owl (breeding) have ruled out by survey.
- *Calyptorhynchus lathami* Glossy Black-Cockatoo (Breeding) – Afternoon / evening observation surveys were undertaken on 17th August and 21st August to detect any of these birds returning to potential nesting hollows around the edges of the subject land. The survey timing in August is within the breeding season of the species. No sightings or calls of Glossy Black-Cockatoo were made (refer to Appendix D). The species credits for Glossy Black-Cockatoo (Breeding) have ruled out by survey.
- *Asterolasia buxifolia* – The subject land does not contain suitable creek corridor habitat but was nevertheless searched across the full extent of the site in late September 2023. No plants of this species were found. The species is ruled based on absence by survey, as well as lack of any suitable habitat.

- *Eucalyptus aggregata* Black Gum – The subject land does not contain frost hollows comrpising habitat for this species, but was nevertheless searched across the full extent of the site in late September 2023. No plants of this species were found. The species is ruled out by survey.
- *Eucalyptus pulverulenta* Silver-leafed Gum – The subject land could provide suitable habitat conditions for this species, however is cleared and heavily grazed and lacking trees. The subject land was searched across the full extent of the site in late September 2023. No plants of this species were found. The species is ruled out by survey.
- *Leucochrysum albicans* subsp. *tricolor* Hoary Sunray – The subject land does provide suitable derived grassland habitat for this species and it could be present, despite the grazing land use history. The subject land was searched across the full extent of the site in late September 2023. The pure yellow-flowering *Leucochrysum albicans var albicans* was found during the survey, just to the west of the subject land (Photograph 4-2). No plants of the white-flowering *Leucochrysum albicans* subsp. *tricolor* were found. The presence of the yellow-flowering taxon in found during the survey reflects the reliability of survey for the threatened *Leucochrysum albicans* subsp. *tricolor*, which was not found, due to the growth form and flowering period being similar for both taxa. Conditions were considered suitable for detecting the threatened form subsp. *tricolor* if it was present. This species is ruled out by survey.
- *Thesium australe* Austral Toadflax – Grows in grassland or woodland, often in damp sites. The subject land could provide suitable habitat conditions for this species, however is cleared and heavily grazed. The subject land was searched across the full extent of the site in late September 2023. No plants of this species were found. The species is ruled out by survey.

Photograph 4-2. The yellow-flowering Leucochrysum albicans var albicans was found during the survey, just to the west of the subject land, and is not the threatened Leucochrysum albicans subsp. tricolor.

One species with habitat on the subject land has been retained as a species credit due to not being surveyed within the seasonal requirement, due to time constraints on the assessment, described below.

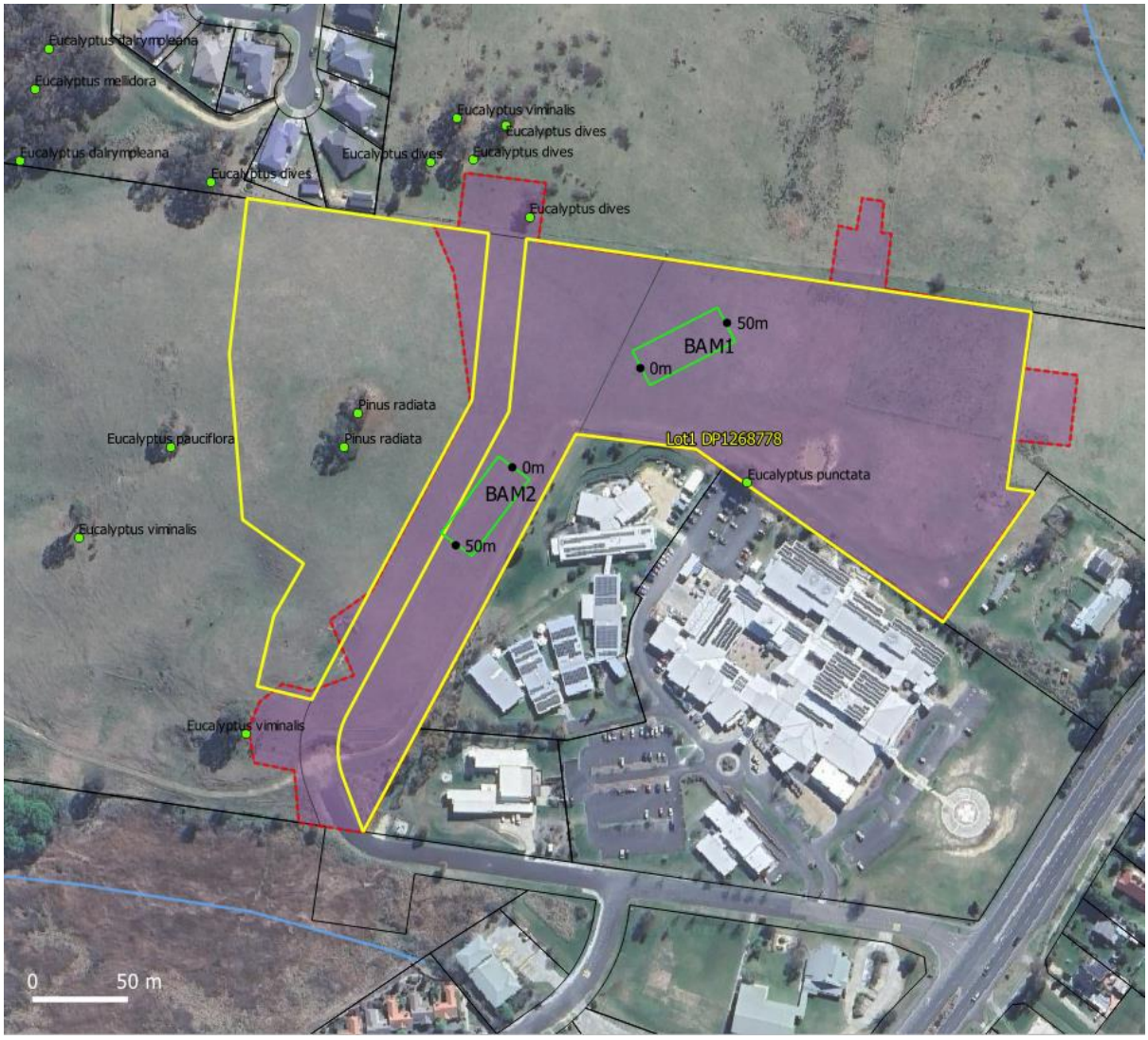
- *Chalinolobus dwyeri* Large-eared Pied Bat – The TBDC identifies foraging habitat as any suitable vegetation on the subject land within 2km of cliffs or caves or other potential breeding shelters. Potential breeding habitat is PCTs associated with the species within 100m of rocky areas containing caves, or overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings.

The current development site is not potential breeding habitat for Large-eared Pied Bat due to nearest cliffs and caves being located in the Hassans Walls reserve approximately 1km to the east of the subject land.

The site is within 2km of cliffs or caves and is required to be considered as potential habitat. The TBDC states '*All habitat on the subject land should also be mapped if present. Use high resolution aerial imagery and topographic maps to identify potential roost habitat features on the subject land within 2km caves, scarps, cliffs etc. Species polygon boundary should align with PCTs on the subject land to which the species is associated that are within 2km of identified potential roost habitat features*.' This species requires survey to occur in November-December-January. The required timing of this BDAR meant that the survey for this species was not able to be undertaken within the required November-December-January seasonal timing. This assessment therefore assumes species presence for foraging.

A species polygon for the Large-eared Pied Bat has been mapped around the entire subject land in accordance with the BAM. The species polygon is 4.6 ha as shown in **Figure 4-2**. This area has been used to calculate the number of *Chalinolobus dwyeri* Large-eared Pied Bat credits (non-breeding habitat) produced by the development, as detailed in **section 6**.

Figure 4-2. Species polygon for Chalinolobus dwyeri Large-eared Pied Bat (non-breeding forage habitat).



4.3 SAII species

The following species relevant to the subject land are potential serious and irreversible impact (SAII) species predicted for the site and vegetation PCT. The site assessment of habitat features and the targeted surveys implemented have ruled out the presence of these species, as described in section 4.2 above. The development will not impact any SAII species.

- *Asterolasia buxifolia* – The site does not contain suitable creek lines where this species occurs, and also was not detected by targeted survey in October.
- *Petrogale penicillata* Brush-tailed Rock-wallaby – The site does not contain suitable sheltered rock habitat or forest for this species. The site is also separated by the Great Western Highway and urban development from potential habitat in Hassans Walls Reserve. There are no recent records for this species in the reserve and it is unlikely to occur there either.
- *Chalinolobus dwyeri* Large-eared Pied Bat, SAII species for breeding. The TBDC identifies potential breeding habitat is PCTs associated with the species within 100m of rocky areas containing caves, or overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings. The current development site is not potential breeding habitat for Large-eared Pied Bat due to nearest cliffs and caves being located in the Hassans Walls reserve approximately 1km to the east of the subject land.
- *Mixophyes balbus* Stuttering Frog – This species is found in rainforest and wet, tall open forest and breeds in streams during summer after heavy rain. Outside the breeding season, adults live in deep leaf litter and thick understorey vegetation on the forest floor. There are no permanent streams or vegetation along watercourses on the site, nor any thick vegetation cover and leaf litter. The land is cleared throughout and heavily grazed with almost no leaf litter cover. This species is excluded based on habitat degraded.

Table 4-1. Ecosystem and species credit species relevant to the subject land.

Class Of Credit	Scientific Name	Vernacular Name	NSW status	Federal status	Type	Months Of Survey	Months Of Survey Breeding	Site assessment (species credit)	Site assessment (ecosystem credit)
Ecosystem	*Falco subniger*	Black Falcon	Vulnerable	Not Listed	Birds	N/A		NA	Retained as predicted
Ecosystem	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	Vulnerable	Not Listed	Birds			NA	Retained as predicted
Ecosystem	*Stagonopleura guttata*	Diamond Firetail	Vulnerable	Not Listed	Birds			NA	Retained as predicted
Ecosystem	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	Vulnerable	Not Listed	Birds			NA	Retained as predicted
Ecosystem	*Petroica phoenicea*	Flame Robin	Vulnerable	Not Listed	Birds			NA	Retained as predicted
Ecosystem	*Glossopsitta pusilla*	Little Lorikeet	Vulnerable	Not Listed	Birds			NA	Retained as predicted
Ecosystem	*Dasyurus maculatus*	Spotted-tailed Quoll	Vulnerable	Endangered	Marsupials			NA	Retained as predicted
Ecosystem	*Chthonicola sagittata*	Speckled Warbler	Vulnerable	Not Listed	Birds			NA	Retained as predicted
Ecosystem	*Varanus rosenbergi*	Rosenberg's Goanna	Vulnerable	Not Listed	Reptiles			NA	Retained as predicted
Ecosystem	*Petroica boodang*	Scarlet Robin	Vulnerable	Not Listed	Birds			NA	Retained as predicted
Ecosystem	*Circus assimilis*	Spotted Harrier	Vulnerable	Not Listed	Birds			NA	Retained as predicted
Ecosystem	*Daphoenositta chrysoptera*	Varied Sittella	Vulnerable	Not Listed	Birds			NA	Retained as predicted
Ecosystem	*Hirundapus caudacutus*	White-throated Needletail	Not Listed	Vulnerable	Birds			NA	Retained as predicted
Species/ Ecosystem	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	Vulnerable	Not Listed	Birds		January; February; March; April; May; June; July; August;	Surveyed not breeding	Excluded due to habitat constraint

							September		absent (no Allocasuarina)
Species/ Ecosystem	*Lophoictinia isura*	Square-tailed Kite	Vulnerable	Not Listed	Birds		January; September; October; November; December	Surveyed not breeding	Retained as predicted
Species/ Ecosystem	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	Vulnerable	Not Listed	Bats		January; February; December	No habitat on site	Retained as predicted
Species/ Ecosystem	*Ninox connivens*	Barking Owl	Vulnerable	Not Listed	Birds		May; June; July; August; September; October; November; December	Surveyed not present	Retained as predicted
Species/ Ecosystem	*Ninox strenua*	Powerful Owl	Vulnerable	Not Listed	Birds		May; June; July; August	Surveyed not present	Retained as predicted
Species/ Ecosystem	*Pteropus poliocephalus*	Grey-headed Flying-fox	Vulnerable	Vulnerable	Bats		October; November; December	Surveyed not breeding	Retained as predicted
Species/ Ecosystem	*Tyto novaehollandiae*	Masked Owl	Vulnerable	Not Listed	Birds		May; June; July; August	Surveyed not present	Retained as predicted
Species/ Ecosystem	*Callocephalon fimbriatum*	Gang-gang Cockatoo	Vulnerable	Endangered	Birds		January; October; November; December	Surveyed not breeding	Retained as predicted
Species/ Ecosystem	*Hieraaetus morphnoides*	Little Eagle	Vulnerable	Not Listed	Birds		August; September; October	Surveyed not breeding	Retained as predicted
Species/ Ecosystem	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	Vulnerable	Not Listed	Birds		July; August; September; October; November; December	Surveyed not breeding	Retained as predicted

Species	*Asterolasia buxifolia*	Asterolasia buxifolia	Endangered	Not Listed	Shrubs	September; October; November		Surveyed not present	NA
Species	*Burhinus grallarius*	Bush Stone-curlew	Endangered	Not Listed	Birds	January; February; March; April; May; June; July; August; September; October; November; December		No habitat on site	NA
Species	*Cercartetus nanus*	Eastern Pygmy-possum	Vulnerable	Not Listed	Marsupials	January; February; March; October; November; December		No habitat on site	NA
Species	*Chalinolobus dwyeri*	Large-eared Pied Bat	Vulnerable	Vulnerable	Bats	January; November; December		Habitat present	NA
Species	*Delma impar*	Striped Legless Lizard	Vulnerable	Vulnerable	Reptiles	September; October; November; December		No habitat on site	NA
Species	*Eucalyptus pulverulenta*	Silver-leafed Gum	Vulnerable	Vulnerable	Mallees	January; February; March; April; May; June; July; August; September; October; November; December		Surveyed not present	NA
Species	*Litoria aurea*	Green and Golden Bell Frog	Endangered	Vulnerable	Amphibians	January; February; March; November; December		No habitat on site	NA
Species	*Litoria booroolongensis*	Booroolong Frog	Endangered	Endangered	Amphibians	October; November; December		No habitat on site	NA

Species	*Litoria raniformis*	Southern Bell Frog	Endangered	Vulnerable	Amphibians	January; October; November; December		No habitat on site	NA
Species	*Mixophyes balbus*	Stuttering Frog	Endangered	Vulnerable	Amphibians	January; February; March; September; October; November; December		No habitat on site	NA
Species	*Paralucia spinifera*	Purple Copper Butterfly, Bathurst Copper Butterfly	Endangered	Vulnerable	Invertebrates	September; October; December		No habitat on site	NA
Species	*Petrogale penicillata*	Brush-tailed Rock-wallaby	Endangered	Vulnerable	Marsupials	January; February; March; April; May; June; July; August; September; October; November; December		No habitat on site	NA
Species	*Phascogale tapoatafa*	Brush-tailed Phascogale	Vulnerable	Not Listed	Marsupials	January; February; March; April; May; June; December		No habitat on site	NA
Species	*Phascolarctos cinereus*	Koala	Endangered	Endangered	Marsupials	January; February; March; April; May; June; July; August; September; October; November; December		Surveyed not present	NA
Species	*Thesium australe*	Austral Toadflax	Vulnerable	Vulnerable	Herbs and Forbs	January; February; November; December		Surveyed not present	NA
Species	*Eucalyptus aggregata*	Black Gum	Vulnerable	Vulnerable	Trees	January; February; March; April; May; June; July; August; September;		Surveyed not present	NA

						October; November; December			
Species	*Leucochrysum albicans var. tricolor*	Hoary Sunray	Not Listed	Endangered	Herbs and Forbs	January; February; March; April; September; October; November; December		Surveyed not present	NA
Species	*Petauroides volans*	Greater Glider	Not Listed	Vulnerable	Marsupials	January; February; March; April; May; June; July; August; September; October; November; December		No habitat on site	NA

5 Impact assessment

The following impact summary contains recommendations to avoid and minimise impacts of the development. Some of these measures may enable ecosystem credits to be taken out of the calculations, such as if some areas can be set aside as 'non-development' conservation areas on the lots, e.g. the riparian corridor, the woodland patches.

5.1 Measures to avoid and minimise impacts

The following measures have been proposed to reduce the potential impacts of the proposed development on the local ecology of the site and to reduce the biodiversity credits produced.

Development siting

The subject site is an existing derived grassland site cleared of trees other than two large pines (*Pinus radiata*) on top of the hill and one tree of *Eucalyptus dives* (Broad-leaved Peppermint) on the northern corner of the site, on the adjoining lot (Lot 2 DP1049398). The derived grassland on the site has been heavily grazed over a long period and has lost much of the native groundcover composition and habitat values of an intact native grassy woodland.

On the basis that the site is cleared of woody vegetation and the groundcover comprises mixed native/ non-native species, the site is generally considered to be suitable for development.

There is existing surrounding development including the Lithgow Hospital immediately to the east and nearby subdivisions to the northwest, north and south. The current proposal is situated immediately adjacent to existing development and therefore does not further fragment any natural areas or woodland or forest.

The location of the connector road through the proposed subdivision is constrained by needing to connect to the alignment of a road within an approved subdivision on land to the north, on Lot 2 DP1049398. A temporary turning facility is proposed to be installed by Council's if the adjoining subdivision works have not already constructed the road on the adjoining land. This will result in the unavoidable impact to one hollow-bearing habitat tree of *Eucalyptus dives* (Broad-leaved Peppermint), as specified by the project engineer. Reference is made to the letter of J. Wyndham Prince Consulting Civil Infrastructure Engineers & Project Managers, dated 5/12/2023 included in Appendix E. The loss of one hollow-bearing habitat tree is deemed by the Proponent to be unavoidable impact due to the need for the road linkages between the two subdivisions.

Retained areas of green space and forest

The subdivision development includes the retention as open space of a large portion of the main subject lot (Lot 1 DP 1268778) on the western side. The proposed open space on Lot 1 DP 1268778 is situated between the *Phragmites* wetland to the south and the creek corridor and forest areas to the west (refer to Figure 1- 3). The forest areas to the northwest of the site is on Council land and contains vegetation of PCT 3348 including numerous hollow-bearing trees. This area provides the opportunity for protection of habitat values in the local area and connectivity to the Cox's River corridor further to the west.

It is recommended as a mitigation and management measure for the proposal, that a vegetation management and habitat restoration plan be prepared to guide the ecological restoration of Council-owned land to the south and west of the subdivision.

Habitat trees

Avoiding impact to large hollow-bearing habitat trees and food resource trees is a key measure to address the principle of avoid and minimise impacts ahead of mitigation such as offsetting. Habitat trees can be protected from development impact by providing a buffer and/or tree protection zones around such trees and including robust protection measures such as temporary fencing installed before works commence.

There are two hollow-bearing habitat trees on or near the development site. These tree are an important habitat resource for fauna providing hollows that are relatively rare in the landscape.

As shown earlier in Figure 1-7, the proposed development footprint contains one hollow-bearing tree of *Eucalyptus dives* (Broad-leaved Peppermint) in the north and a second large tree of *Eucalyptus viminalis* (Ribbon Gum) adjacent to the proposed road in the south.

Recommended tree protection zones are indicated in Figure 5-1 and Figure 5-2. The development design and any road works at either location would ideally provide adequate measures to avoid impacting these trees with no works to occur within the tree protection zones.

Due to the alignment of the connector road linking current proposed subdivision with the adjoining subdivision already approved, Council has advised there will be unavoidable impact to the *Eucalyptus dives* (Broad-leaved Peppermint) on the north side. This tree has been assessed during the targeted fauna surveys for threatened owls, Glossy Black-cockatoo, Gang-gang Cockatoo and Koala with no sightings of use by these species (refer to Table 1-3 for survey dates).

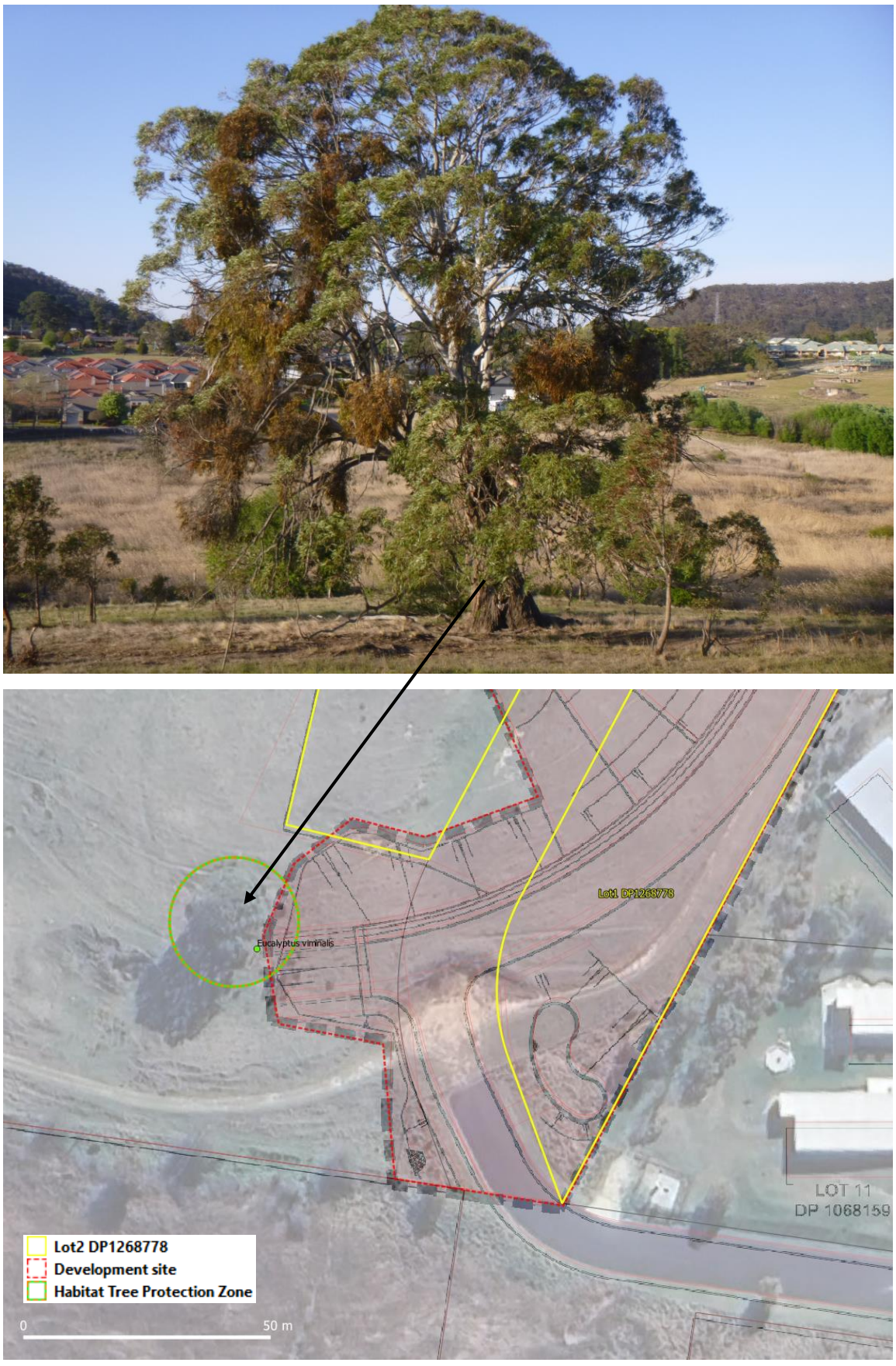
The second hollow-bearing tree of *Eucalyptus viminalis* (Ribbon Gum) occurs just outside the south-western site boundary. There is an apparent new road leading towards this tree as indicated on the plan for the proposal, as shown in Figure 5-2. This tree has multiple hollows and was observed during the site assessment to be used by numerous and diverse native birds for roosting and foraging. This tree is an important habitat tree in the local landscape and warrants protection from development impact. A tree protection zone with temporary exclusion fencing is recommended to be installed at the dripline of the canopy to protect this tree from development impact and address the requirement to avoid and minimise impact for this development.

The proposed subdivision will result in the unavoidable impact to one habitat tree on the northern side and avoidance of impact to a second habitat tree on the southern side.

It is proposed as a mitigation measure for impact to this tree to prepare a Vegetation Management Plan to manage and restore native vegetation habitat on Council land to the west of the site. This area contains some large trees and vegetation of the same PCT as the development site with stands of trees with hollows.

Figure 5-1. Hollow-bearing habitat tree of Eucalyptus dives (Broad-leaved Peppermint) at the northern edge of the proposed development, on the adjoining Lot 2 DP 1049398.

Figure 5-2. Large habitat tree of Eucalyptus viminalis (Ribbon Gum) at the southern edge of the proposed development, where an exclusion zone is recommended to be installed at the drip line of the canopy edges to address avoid and minimise impacts. This tree hosts numerous hollows and mistletoe which provide important resources for fauna.



Vegetation management plan and habitat restoration

The BAM section 8.4.1 '*Mitigate impacts on native vegetation, threatened species, threatened ecological communities and their habitat*' identifies vegetation management plan and habitat restoration as a suitable approach to mitigating biodiversity impacts of development, as a separate measure to the required offset credits [2] .

The proposed open space to be retained on Lot 1 DP 1268778 provides a suitable area for ecological restoration and creation of a habitat corridor from the Phragmites wetland to the south through to the forested areas in the creek corridor to the northwest, and towards the Cox's River further west. A habitat corridor will enable native flora and fauna to survive in and move across the local landscape. This is an opportunity to provide a positive biodiversity management showcase project for Lithgow, while also with achieving the residential subdivision.

To mitigate impacts of the development not addressed through biodiversity credits, it is recommended that a vegetation management plan be prepared for the areas of Lot 1 DP 1268778 zoned as C3 Environmental management external to the development site. Site-specific vegetation management actions would need to be scoped and detailed for a long-term management plan and habitat restoration, based on robust ecological principles. Specifically, the plan is recommended to include:

- Scoping and detailing of Vegetation management actions and other actions to achieve native vegetation and habitat restoration of areas of Lot 1 DP 1268778 zoned as C3 Environmental management, including specific habitat features for key local threatened fauna species.
- Revegetation of within the corridor using local provenance trees, shrubs and groundcover species, consistent with PCT 3348 Southern Tableland Granites Ribbon Gum Grassy Forest, and considering appropriate set back from current and future residential areas to avoid exacerbating bushfire risk.
- A weed control program to include management of significant weeds listed under the Biosecurity Act and other High Threat Weeds that impact ecological systems to be eradicated and/or managed through appropriate weed control and bush regeneration methods across the corridor.
- Ensure future plans for local development and/or strategic planning enable effective management and protection of the habitat corridor.
- Landscaping works within the subdivision areas to include the planting of native flora species of local provenance, ideally sourced from local providers.

An indicative area for the restoration 'habitat corridor' is mapped in the Figure 6-1.

[2] The BAM section 8.4.1 identifies the following mitigation measures, among other measures, suitable to address impacts to biodiversity resulting from development as separate measures to the required offsets:

- preparing a vegetation management plan to regulate activity in vegetation and habitat adjacent to residential developments. The plan may include controls on pet ownership, rubbish disposal, wood collection, fire management and disturbance to nests and other niche habitats,
- providing for the ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on, or adjacent to, the development or clearing site'

5.2 Direct impacts

The direct impact to native vegetation is summarised in Table 5-1.

Table 5-1. Impact to native vegetation and habitat.

Vegetation Zone	Total zone area impacted (ha)	Proposed development impact
PCT 3348 derived grassland	4.6 ha	Complete clearing of this area of derived grassland required for establishment of the subdivision including roads. The entire subdivision footprint has been assumed to be impacted There are no rock outcrops or other sensitive features in on the subject land that comprise important habitat for threatened species.

The proposed development footprint contains one hollow-bearing tree of *Eucalyptus dives* (Broad-leaved Peppermint) in the north-western corner, as shown in Figure 5-1. This tree is located within the disturbance footprint required for a turning head on the adjoining Lot 2 DP1049398. Council has advised (pers comm. S. Hanrahan, 5/12/23) that this tree will need to be cleared for the road turning head for the Council subdivision if not already cleared for the adjoining approved subdivision (refer to engineers letter in Appendix E). The location of this turning head is constrained by the need to connect to a future road within a planned subdivision on Lot 2 DP1049398, which was approved by LCC on 24 August 2022.

5.3 Indirect impacts

The indirect impacts of the development could include:

- reduced viability of adjacent habitat due to edge effects;
- reduced viability of adjacent habitat due to noise, light spill, domestic pets, traffic;
- transport of weeds and pathogens from the site to adjacent vegetation.

These potential impacts are expected to be minimal due in the context of the existing surrounding development and location of the site adjacent to existing development including the Lithgow Hospital and residential suburbs.

A large hollow-bearing tree of *Eucalyptus viminalis* (Ribbon Gum) occurs just outside the south-western site boundary, as shown in Figure 5-2. It is recommended any future road be aligned to avoid this tree and provide an appropriate tree protection zone with temporary exclusion fencing installed at the dripline of the canopy to protect this tree from development impact.

5.4 Prescribed Impacts

The *Biodiversity Conservation Regulation* 2017 lists nine impacts as prescribed impacts that must be avoided, minimised and mitigated. These prescribed impacts and their relevance to the proposal are described in Table 5-2.

Table 5-2. Prescribed impacts of the proposal and mitigation measures.

Prescribed Impact (*Biodiversity Conservation Regulation 2017*)	Site attributes and impact avoidance and mitigation measures
Impacts on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other features of geological significance.	These habitats are not present on the subject land and will not be directly impacted.
Impacts of development on the habitat of threatened species or ecological communities associated with rocks	There 6is no surface rock present on the subject land. Suitable rock habitat for threatened species is not present within the development site.
Impacts of development on the habitat of threatened species or ecological communities associated with human made structures	No human made structures will be disturbed by the proposal or occur on the development site. No mitigation required.
Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation	The subject land contains derived grassland with a mix of native and exotic groundcover species. There are no shrub thickets or other non-native woody vegetation that could provide shelter or habitat for threatened species. The large pines on the hill top are not within the development site and will not be impacted.

Prescribed Impact (*Biodiversity Conservation Regulation 2017*)	Site attributes and impact avoidance and mitigation measures
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range.	The proposal will have a minor impact on the connectivity of threatened species habitat. The proposal will develop a portion of an area of open grassland utilised by Eastern Gey Kangaroo. The proposal is located on existing cleared land that has been heavily grazed by stock would have limited use by threatened species. Large trees are present around the site, separated by relatively large distances of >100m from any areas of intact forest. The site adjoins existing residential development and the Lithgow Hospital. There is one mature tree of *Eucalyptus dives* at the northern most edge of the site in the line of a connecting road to the adjoining approved subdivision site to the north. Council has advised the impact to this tree is unavoidable. Impact to one habitat tree is not likely to significantly affect the connectivity of habitat for threatened species in the local area. The approved subdivision to the north of the subject site will remove habitat connectivity on this side. Another large tree of *Eucalyptus viminalis* is situated near the south western corner of the site. Council has advised this tree can be avoided by the works and will therefore be retained in the landscape as a habitat resource. The development will avoid impact to the forest areas in the creek gully to the northwest of the site, which provides for maintaining connectivity to the Cox's River corridor further to the west. The Cox's River corridor is an important habitat corridor in the local area and will not be impacted by the proposal. Overall, the subject land proposed for the subdivision has some importance for the movement of wildlife through the area which is being increasingly developed for residential suburbs of Lithgow. The design of the current proposal includes the retention of a substantial portion of Lot 1 DP 1268778 which will retain an open space habitat corridor connecting the Phragmites wetland to the south and the Council-owned land along the creek corridor to the west. These areas to be retained as open space will maintain connectivity of fauna habitat through the local area, including connecting to the creek corridor and forest areas leading to the Cox's River further west. Opportunities exist for the vegetation management and ecological restoration of this area to mitigate impacts of the subdivision development. A vegetation management plan would be consistent with the BAM section 8.4 *Mitigate and manage impacts on biodiversity values*, and is identified as a mitigation measure in section 5.1 of this report.
Impacts of the development on movement of threatened species that maintains their life cycle.	The proposal is located on existing cleared land that has been heavily grazed . The proposal adjoins existing developed areas including the Lithgow Hospital and residential suburbs. Trees in the local landscape are external to the development site and not subject to the current development. There is one mature tree of *Eucalyptus dives* at the northern most edge of the site in the line of a connecting road to the adjoining approved subdivision site to the north. Council has advised the impact to this tree is unavoidable. Impact to one habitat tree is not likely to significantly affect the connectivity of habitat for threatened species in the local area. The approved subdivision to the north of the subject site will remove habitat connectivity on this side. Another large tree of *Eucalyptus viminalis* is situated near the south western corner of the site. Council has advised this tree can be avoided by the works and will therefore be retained in the landscape as a habitat resource. The proposal is not expected to impact the movement of threatened species to a degree that would their life cycles (breeding, foraging or migration). There are no migratory species or paths that would be impacted by the proposal.

Prescribed Impact (*Biodiversity Conservation Regulation 2017*)	Site attributes and impact avoidance and mitigation measures
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities.	The subject land does not contain any watercourses (refer to site map in **Figure 1-2**). Therefore, there are no expected impacts to any watercourses or riparian habitats as a result of the proposed subdivision. The nearest mapped watercourse is a first order tributary of the Cox's River, located approximately 60m to the south of the site, flowing towards the west. This watercourse is associated with a large expanse of *Phragmites australis* (Common Reed), indicated as a wetland in **Figure 1-2**. The Cox's River itself is located some 1600m to the northwest. Appropriate soil and sediment control measures will need to be in place as part of the development conditions to mitigate any potential impacts on water quality. The control of erosion and the prevention of silt discharge into drainage systems and waterways will be necessary in accordance with Landcom's Soils and Construction Manual - April 2004. Erosion control measures should be in place prior to the commencement of any earthworks and maintained until completion and restoration of site earthworks, including revegetation of all exposed areas.
Impacts of wind turbine strikes on protected animals	Not relevant to the proposal.
Impact of vehicle strikes on threatened species of animals or on animals that are part of a TEC.	There is some risk of increase or ongoing animal strikes by standard and heavy vehicles entering and exiting the site. Traffic control measures are expected to be in place as part of the development conditions and will mitigate potential animal strikes.

5.5 Serious and Irreversible Impacts

The proposal does not affect any entities under the potential serious and irreversible impact (SAII) in the guidelines (as per clause 6.7 of the Biodiversity Conservation Regulation 2017).

The following SAII species are relevant to the proposal and have been addressed in this assessment, refer to **section 4** for details.. It is concluded that the development will not impact any SAII species.

- *Asterolasia buxifolia* – no suitable habitat is present on the site, also surveyed and found not present.
- *Petrogale penicillata* Brush-tailed Rock-wallaby – no suitable habitat is present on the site, there is no connectivity to potential habitat in the Hassans Walls Reserve due to surrounding development.
- *Chalinolobus dwyeri* Large-eared Pied Bat, is a serious and irreversible impact (SAII) species for breeding. The TBDC identifies potential breeding habitat is PCTs associated with the species within 100m of rocky areas containing caves, or overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings. The current development site is not potential breeding habitat for Large-eared Pied Bat due to nearest cliffs and caves being located in the Hassans Walls reserve approximately 1km to the east of the subject land.
- *Mixophyes balbus* Stuttering Frog – no suitable habitat is present on the site.
- *Litoria castanea* Yellow-spotted Tree Frog – no suitable habitat is present on the site.

6 Summary of impacts

6.1 Area requiring offsets

Areas of impact requiring offset, areas not requiring offset and areas not requiring assessment are mapped in **Figure 6-1**. The ecosystem and species credits produced by the proposal are described in the following sections.

In summary, ecosystem credits have been calculated as nil due to the VI score being below the threshold for producing credits.

The entire development site is required to be offset for *Chalinolobus dwyeri* Large-eared Pied Bat as foraging habitat due to the site being located within 2km of cliff lines in Hassans Walls Reserve. All other candidate threatened species have been ruled out by targeted survey or lack of suitable habitat as described in **section 4**.

6.2 Biodiversity credit report

Output reports from the BAM calculator (Case ID 00042512/BAAS18022/23/00042513, Revision 1, finalised 5.12.2023) are provided in **Appendix C**. The calculations have determined the biodiversity credits produced by the proposal and required to be offset; these are summarised below.

Ecosystem credits

The total number of ecosystem credits has been calculated as follows.

- **Vegetation zone PCT3348 derived grassland**: The current VI score has been calculated in the BAM-C as a value of 10.3. All areas are assumed to have a future integrity score of zero due to the complete clearing required for the subdivision. Based on the zone area of 4.6 ha and a vegetation integrity loss of 10.3, no credits have been produced.

The total number of ecosystem credits calculated for the proposed development is 0 credits, which includes accounting for the predicted ecosystem species (**Table 6-1**). There is no ecosystem credit offset requirement.

Table 6-1 Ecosystem credits requiring offset for the development as determined in the BAM-C.

Zone and PCT/condition	TEC	Impact Area (ha)	Assessed Vegetation Integrity (VI) score	Future VI score	Total VI loss	Credits produced
PCT 3348 derived grassland – paddock trees only	No	4.6 ha	10.3	0	10.3	0

Species credits

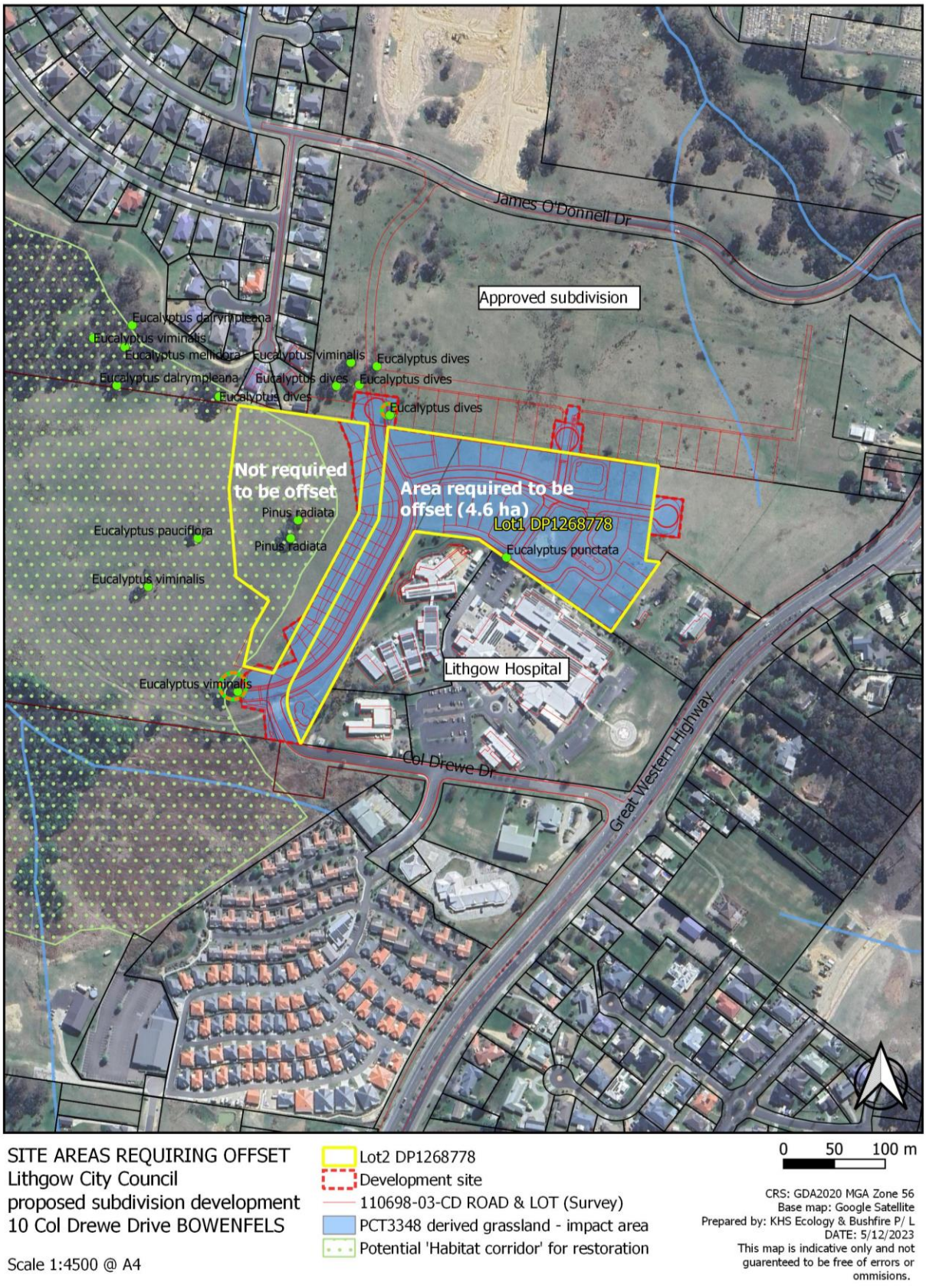
The subject land is assessed as habitat for *Chalinolobus dwyeri* Large-eared Pied Bat (non-breeding habitat) due to being within 2km of cliffs and potential caves on Hassans Walls and containing a PCT 3348 associated with this species. The species polygon is mapped across the entire development site of 4.6 ha, which contains the associated vegetation community, PCT 3348 derived grassland.

The assessment has calculated 35 species credits for *Chalinolobus dwyeri* Large-eared Pied Bat are produced by the development clearing (**Table 6-2**). The proponent will be required to retire these species credits unless it can be demonstrated that the species is absent from the site by targeted survey.

Table 6-2 Species credits requiring offset for the development as determined in the BAM-C.

Species and zone	Species polygon area (ha) / Count	Biodiversity risk	Biodiversity Risk Weighting	Potential SAII	Credits produced
Chalinolobus dwyeri Large-eared Pied Bat PCT 3348 derived grassland	4.6 ha	Very High	3	Yes (for breeding)	35

Figure 6-1. Areas required to be offset and proposed native vegetation and habitat restoration areas.



7 Conclusion

Based on the current assessment, the proposal is required to offset:

- 0 ecosystem credits for PCT 3348,
- 35 species credits for *Chalinolobus dwyeri* Large-eared Pied Bat, assumed present for foraging due to the site being within 2km of cliff lines in Hassans Walls reserve (refer to BAM-C outputs in Appendix C).

The biodiversity credits for *Chalinolobus dwyeri* Large-eared Pied Bat will need to be offset by the developer by either paying directly to the Biodiversity Conservation Trust Fund or purchasing the credits on the open market. The price of credits is not provided in the BAM-C and therefore will need to be determined by either requesting a quote from the Biodiversity Conservation Trust or by seeking out prices on the credit market.

Targeted fauna survey for *Chalinolobus dwyeri* Large-eared Pied Bat could be undertaken from November-January and, if found absent by survey, the credits produced for this species may be able to be excluded. This would require a revision of the current BAM calculations.

A vegetation management and habitat restoration plan is recommended to be prepared as a mitigation measure to address the impacts of the development, as a separate measure to the required offset credits. If implemented effectively, a vegetation management and habitat restoration plan will address the objective of 'no net loss to biodiversity' in NSW.

8 References

DECC (2002) Descriptions for NSW (Mitchell) Landscapes Version 2 (Based on descriptions compiled by Dr. Peter Mitchell), report published by the Department of Environment and Climate Change, originally published in 2002, reviewed in 2008.

Keith DA (2004) *Ocean Shores to Desert Dunes: The native vegetation of New South Wales and the ACT*, Department of Environment and Conservation (NSW), Hurstville NSW.

DEC (2006) *The Vegetation of the Western Blue Mountains including the Capertee, Coxs, Jenolan & Gurnang Areas*, published by the Environmental Protection and Regulation Division, Department of Environment and Conservation, Hurstville July 2006.

DPIE (2020) *Biodiversity Assessment Method*, published by the Office of Environment and Heritage for the NSW Government, October 2020.

DPIE (2020) *Biodiversity Assessment Method Operational Manual- Stage 1*, published by the Office of Environment and Heritage for the NSW Government, December 2018.

DPE (2023a) *BioNet Vegetation Classification and Plant Community Type profiles*, retrieved from https://www.environment.nsw.gov.au/research/Visclassification.htm

DPE (2023b) *BioNet Threatened Species Data Collection* (including Wildlife Atlas, Threatened Species Profiles and related documents including the Scientific Committee listings and advice), retrieved from https://www.environment.nsw.gov.au/threatenedspeciesapp/

9 Appendix A. Site flora species list

Table 9-1 Flora species recorded on the subject land and immediate surrounds.

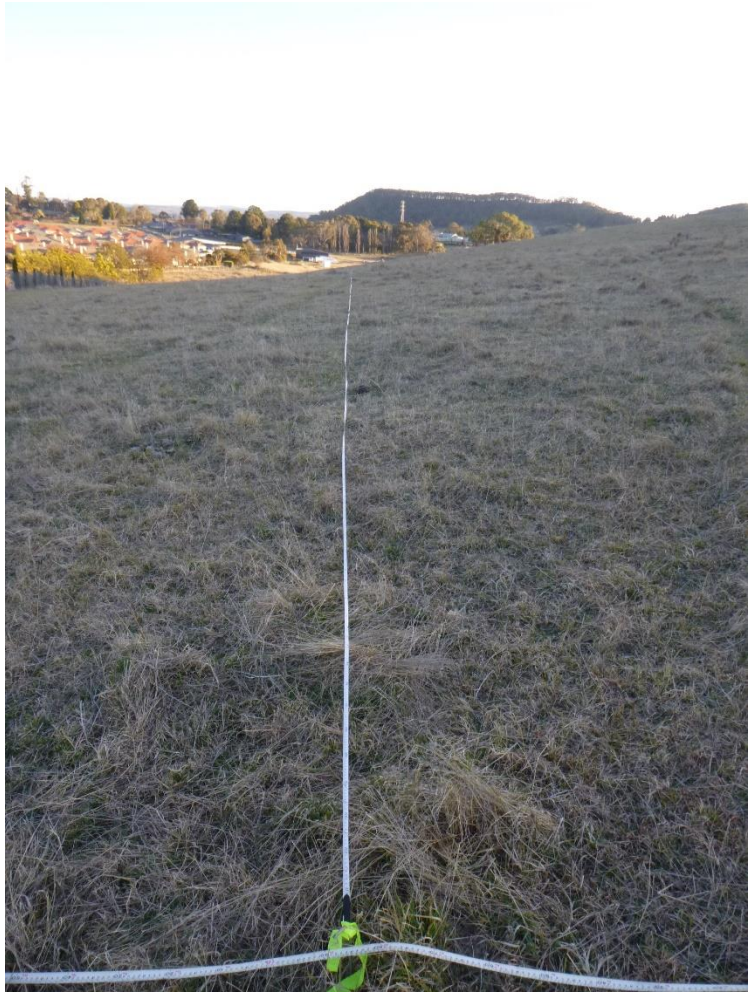
Family	Scientific Name	Common Name	Status*	Growth form	BAM 1 Cover score %	BAM 2 Cover score %
Fabaceae	*Acacia melanoxylon*	Blackwood		Tree		
Fabaceae	*Acacia parramattensis*	Parramatta Wattle		Tree		
Myrtaceae	*Eucalyptus dalrympleana*	Mountain Gum		Tree		
Myrtaceae	*Eucalyptus dives*	Broad-leaved Peppermint		Tree		
Myrtaceae	*Eucalyptus melliodora*	Yellow Box		Tree		
Myrtaceae	*Eucalyptus pauciflora*	White Sally		Tree		
Myrtaceae	*Eucalyptus punctata*	Grey Gum		Tree		
Myrtaceae	*Eucalyptus viminalis*	Ribbon Gum		Tree		
Loranthaceae	*Amyema pendula*	Mistletoe		Other		
Poaceae	*Digitaria diffusa*	Open Summer-grass		Grass & grasslike	10	10
Poaceae	*Austrostipa pubescens*	Speargrass		Grass & grasslike		20
Juncaceae	*Juncus spp.*	A Rush		Grass & grasslike	0.1	0.1
Poaceae	*Microlaena stipoides*	Weeping Grass		Grass & grasslike	20	40
Poaceae	*Panicum spp.*	Panicum		Grass & grasslike	5	
Poaceae	*Poa labillardieri*	Poa Tussock		Grass & grasslike		0.5
Poaceae	*Rytidosperma spp.*	Wallaby Grass		Grass & grasslike		
Poaceae	*Themeda triandra*	Kangaroo Grass		Grass & grasslike		5

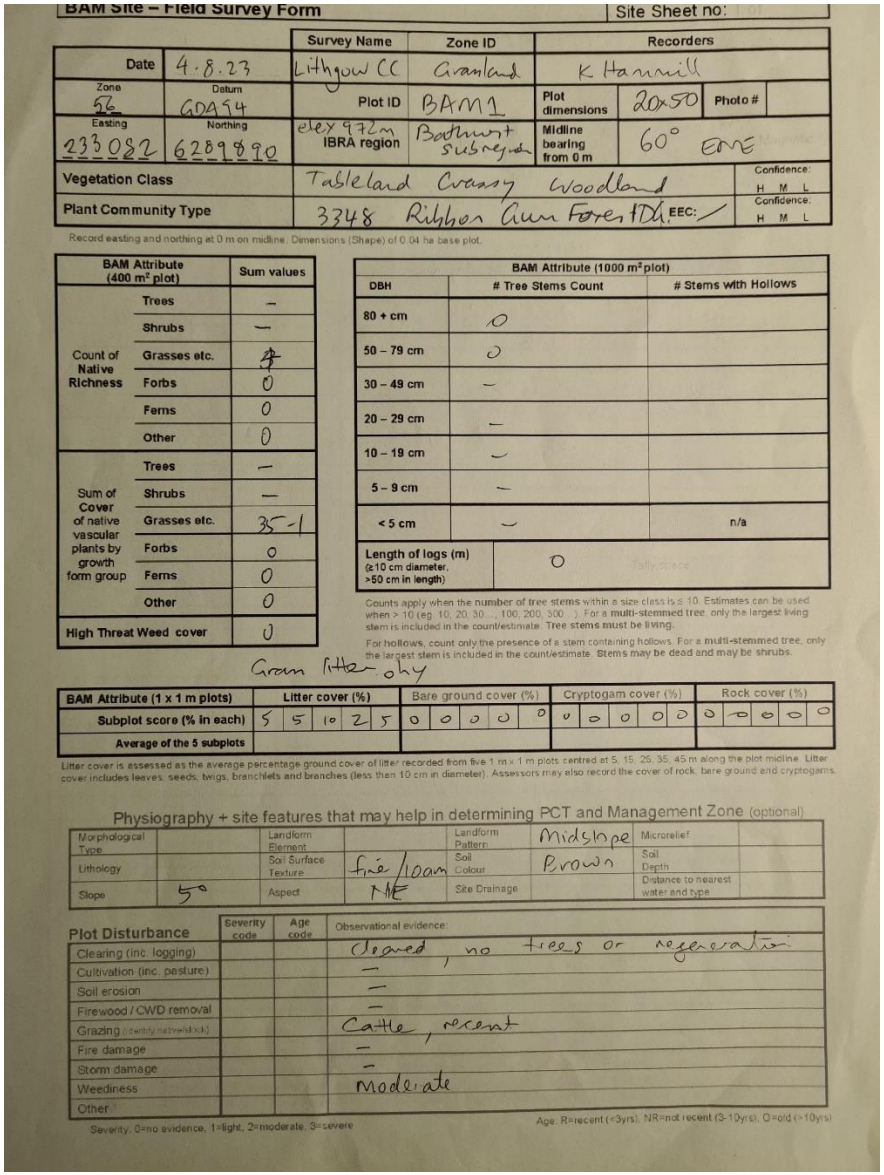
Family	Scientific Name	Common Name	Status*	Growth form	BAM 1 Cover score %	BAM 2 Cover score %
Asteraceae	*Euchiton sphaericus*	Star Cudweed		Forb (FG)		0.1
Asteraceae	*Leucochrysum albicans subsp. albicans*	Paper Daisy		Forb (FG)		
Poaceae	*Anthoxanthum odoratum*	Sweet Vernal Grass		Non-native	15	10
Poaceae	*Dactylis glomerata*	Cocksfoot		Non-native	0.2	
Poaceae	*Eleusine tristachya*	Goose Grass		Non-native	10	
Asteraceae	*Hypochaeris radicata*	Catsear		Non-native	30	15
Poaceae	*Nassella trichotoma*	Serrated Tussock		Non-native	0.1	
Pinaceae	*Pinus radiata*	Radiata Pine		Non-native		
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues		Non-native	0.1	0.1
Rosaceae	*Rosa rubiginosa*	Sweet Briar	HTW	Non-native		
Polygonaceae	*Rumex acetosella*	Sheep Sorrel		Non-native	2	1
Fabaceae	*Trifolium subterraneum*	Subterraneum clover		Non-native	2	
Poaceae	*Paspalum dilatatum*	Paspalum	HTW	Non-native	0.1	
Rosaceae	*Rubus ulmifolius*	Blackberry	HTW	Non-native	0.1	

* For native species: P, Protected; V, Vulnerable; E, Endangered; CE, Critically Endangered under the BC Act 2016 (NSW) or EPBC Act 1999 (Federal). For non-native species: whether the species is considered a High Threat Weed (HTW) as per the BAM supporting technical material.

10 Appendix B. BAM plot data and photographs

Plot ID: BAM 1 Vegetation Zone: PCT 3367 Derived Grassland – Low native cover Easting 233082, Northing 6289890 (GDA94 MGA zone 56) Elevation: 972m Bearing along midline: 60deg ENE Dimensions: 20mx50m	 

Plot ID: BAM 2 Vegetation Zone: PCT 3367 Derived Grassland – High native cover Easting 233015, Northing 6289837 (GDA94 MGA zone 56) Elevation: 980m Bearing along midline: 210deg SSW Dimensions: 20mx50m	 



BAM Site – Field Survey Form | Site Sheet no:

Survey Name	Zone ID	Recorders
Lithgow CC	Grassland	K Hannell

Date	Zone	Datum	Plot ID	Plot dimensions	Photo #
4.8.23	56	GDA94	BAM1	20x50	

Easting	Northing	IBRA region	Midline bearing from 0 m
233082	6289890	elev 972m Bathurst subregion	60° ENE

		Confidence: H M L
Vegetation Class	Tableland Grassy Woodland	
Plant Community Type	3348 Ribbon Gum Forest EEC:	Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	–
	Shrubs	–
	Grasses etc.	4
	Forbs	0
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	–
	Shrubs	–
	Grasses etc.	35-1
	Forbs	0
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	0	
50 – 79 cm	0	
30 – 49 cm	–	
20 – 29 cm	–	
10 – 19 cm	–	
5 – 9 cm	–	
< 5 cm	–	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30 ..., 100, 200, 300 ...). For a **multi-stemmed** tree, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed** tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

Grass litter only

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	5	5	10	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots																				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

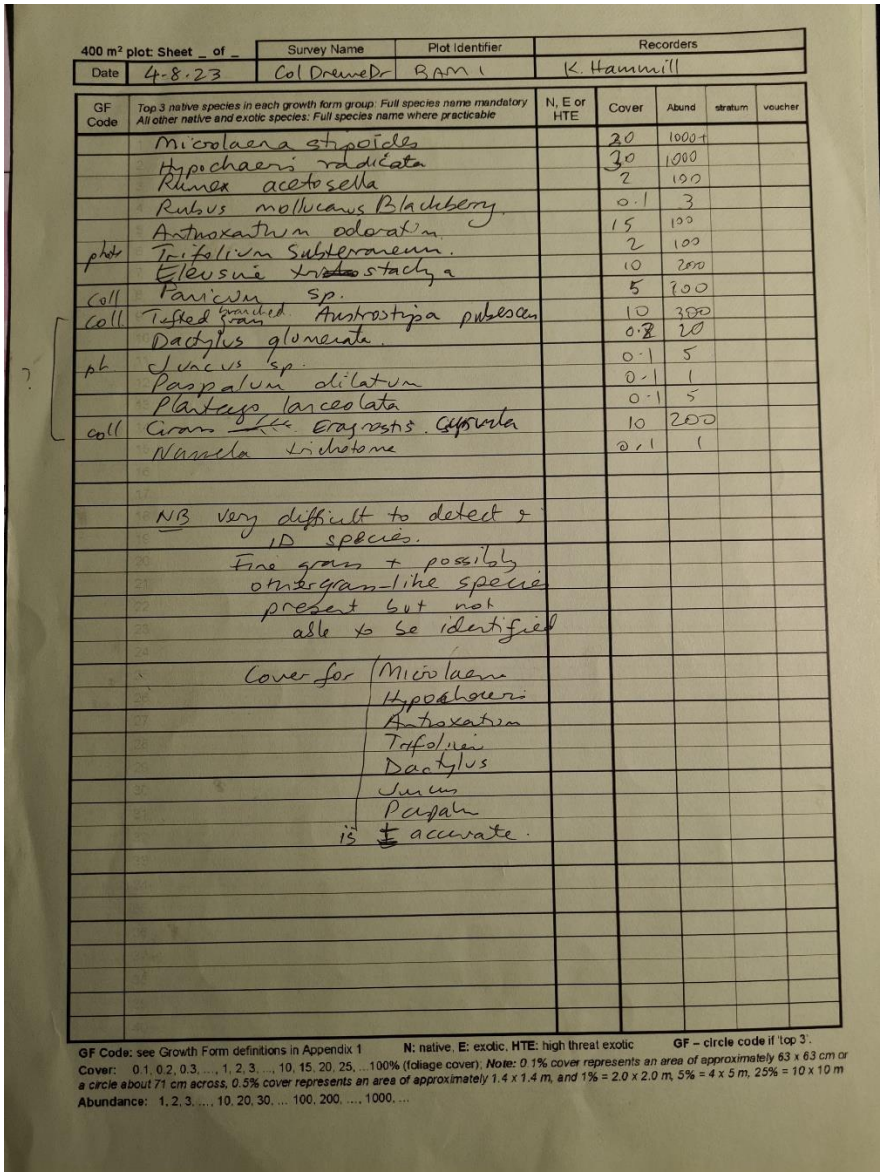
Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern	Midslope	Microrelief	
Lithology		Soil Surface Texture	fine loam	Soil Colour	Brown	Soil Depth	
Slope	5°	Aspect	NE	Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			Cleared, no trees or regeneration
Cultivation (inc. pasture)			–
Soil erosion			–
Firewood / CWD removal			–
Grazing (identify native/stock)			Cattle, recent
Fire damage			–
Storm damage			–
Weediness			moderate
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)



400 m² plot: Sheet _ of _

Survey Name	Plot Identifier	Recorders
Col Drewe Dr	BAM 1	K Hannell

Date: 4.8.23

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	Microlaena stipoides		30	1000+		
	Hypochaeris radicata		30	1000		
	Rumex acetosella		2	100		
	Rubus molluccanus Blackberry		0.1	3		
	Anthoxanthum odoratum		15	100		
plot	Trifolium subterraneum		2	100		
	Eleusine tristachya		10	200		
coll	Paricum sp.		5	100		
coll	Tufted branched Austrostipa pubescens		10	300		
	Dactylus glomerata		0.2	20		
pl	Juncus sp.		0.1	5		
	Paspalum dilatum		0.1	1		
	Plantago lanceolata		0.1	5		
coll	Grass – fine Eragrostis curvula		10	200		
	Nassella trichotome		0.1	1		

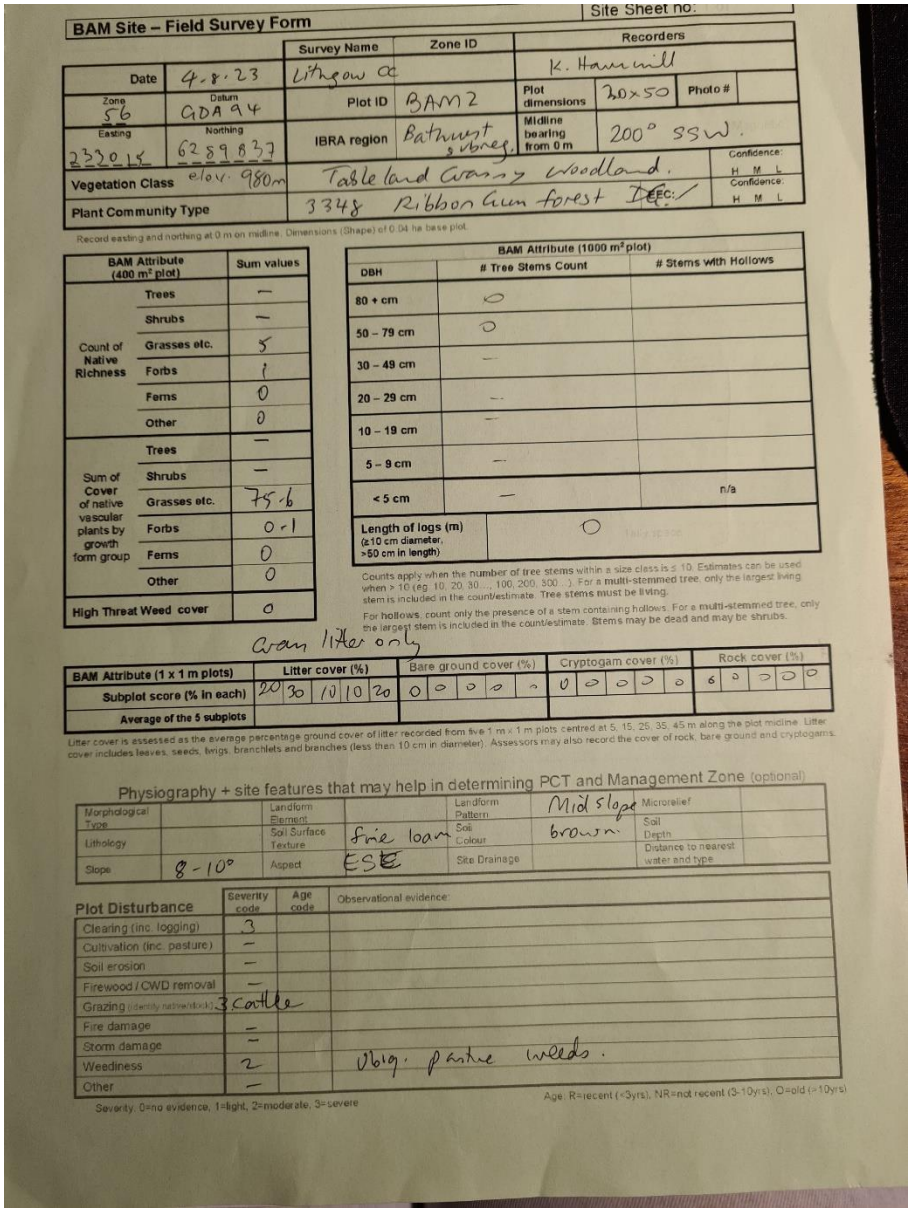
NB very difficult to detect & ID species. Fine grass + possibly other grass-like species present but not able to be identified

Cover for Microlaena Hypochaeris Anthoxanthum Trifolium Dactylus Juncus Paspalum is ± accurate.

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF** – circle code if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...



BAM Site – Field Survey Form Site Sheet no:

Survey Name	Zone ID	Recorders
Lithgow cc		K. Hammill

Date	Datum	Plot ID	Plot dimensions	Photo #
4.8.23	GDA 94	BAM 2	20×50	

Zone	Easting	Northing	IBRA region	Midline bearing from 0 m
56	233015	6289837	Bathurst sub reg.	200° SSW.

		Confidence: H M L
Vegetation Class	e/ov: 980m Tableland Grassy Woodland.	
Plant Community Type	3348 Ribbon Gum forest EEC: ✓	Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	–
	Shrubs	–
	Grasses etc.	5
	Forbs	1
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	–
	Shrubs	–
	Grasses etc.	75.6
	Forbs	0.1
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	0	
50 – 79 cm	0	
30 – 49 cm	–	
20 – 29 cm	–	
10 – 19 cm	–	
5 – 9 cm	–	
< 5 cm	–	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. Tree stems must be living.

For **hollows**, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

Grass litter only

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	20	30	10	10	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots																				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

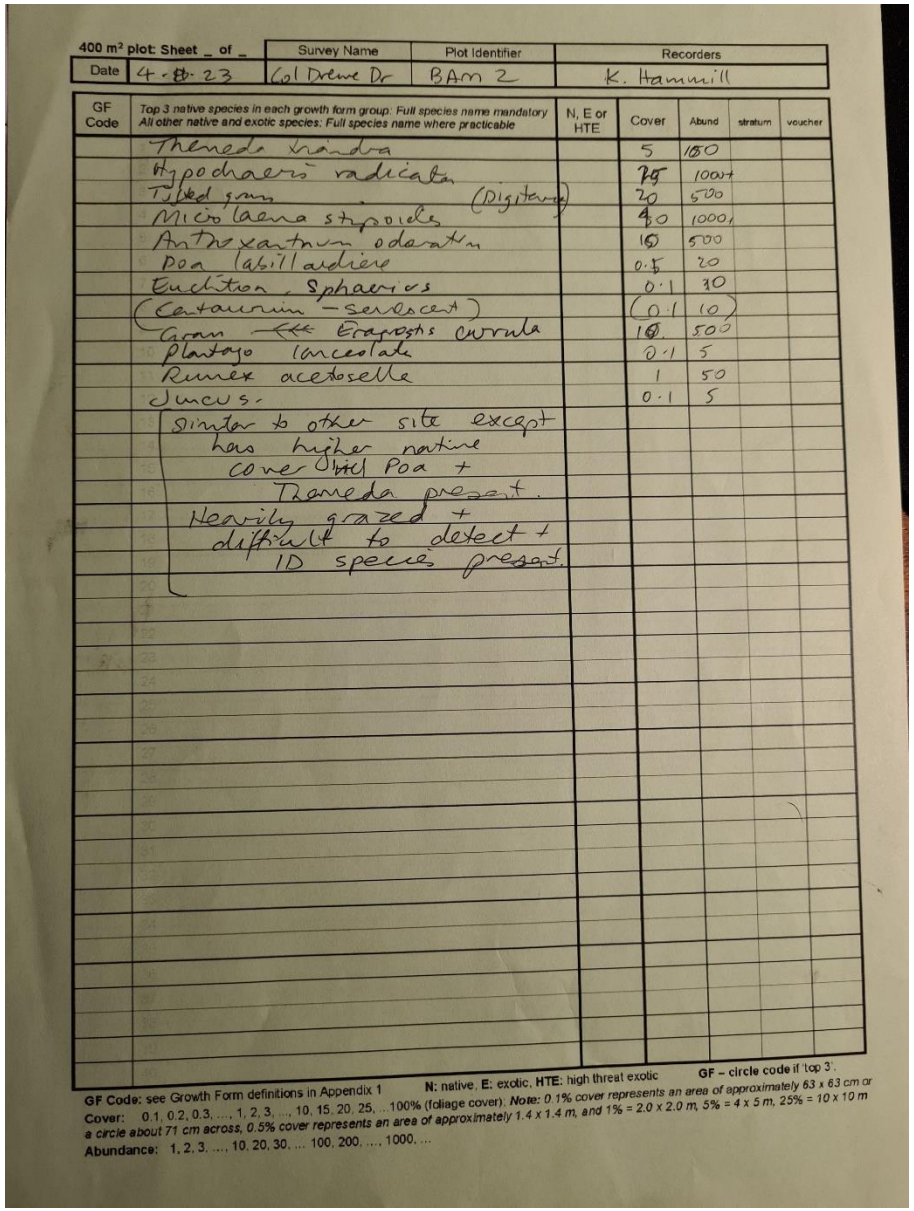
Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern	Mid slope	Microrelief	
Lithology		Soil Surface Texture	fine loam	Soil Colour	brown	Soil Depth	
Slope	8-10°	Aspect	ESE	Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)	3		
Cultivation (inc. pasture)	–		
Soil erosion	–		
Firewood / CWD removal	–		
Grazing (identify native/stock)	3		cattle
Fire damage	–		
Storm damage	–		
Weediness	2		Veg. pasture weeds.
Other	–		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)



400 m² plot: Sheet _ of _

Survey Name	Plot Identifier	Recorders
Col Drewe Dr	BAM 2	K. Hammill

Date: 4.8.23

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	Themeda triandra		5	100		
	Hypochaeris radicata		25	100+		
	Tufted grass (Digitaria)		20	500		
	Microlaena stipoides		40	1000+		
	Anthoxanthum odoratum		10	500		
	Poa labillardiere		0.5	20		
	Euchiton sphaericus		0.1	10		
	(Cotula australis – senescent)		(0.1	10)		
	Grass ~~Eragrostis~~ curvula		10	500		
	Plantago lanceolata		0.1	5		
	Rumex acetoselle		1	50		
	Juncus.		0.1	5		

Similar to other site except has higher native cover ~~Poa~~ + Themeda present. Heavily grazed + difficult to detect + ID species present.

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if top 3.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); *Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

11 Appendix C. BAM Calculator outputs

The following BAM-C outputs are from Version 0, Assessment ID 00042512/BAAS18022/23/00042513, dated 29/10/2023.

NSW GOVERNMENT

BAM Vegetation Zones Report

Proposal Details

Assessment Id	Assessment name	BAM data last updated *
00042512/BAAS18022/23/00042513	Lithgow City Council subdivision 10 Col Drewe Drive South Bowenfels	22/06/2023
Assessor Name	**Report Created**	**BAM Data version ***
Kate Hammill	05/12/2023	61
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS18022	Part 4 Developments (General)	Finalised
Assessment Revision	**Date Finalised**	**BOS entry trigger**
1	05/12/2023	BOS Threshold: Area clearing threshold

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones

NSW GOVERNMENT

BAM Vegetation Zones Report

1	3348_DNG	3348-Southern Tableland Granites Ribbon Gum Grassy Forest	DNG	4.6		

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00042512/BAAS18022/23/00042513	Lithgow City Council subdivision 10 Col Drewe Drive South Bowenfels	22/06/2023
Assessor Name	**Report Created**	**BAM Data version ***
Kate Hammill	05/12/2023	61
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS18022	Part 4 Developments (General)	Finalised
Assessment Revision	**BOS entry trigger**	**Date Finalised**
1	BOS Threshold: Area clearing threshold	05/12/2023

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Black Falcon	Falco subniger	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Diamond Firetail	Stagonopleura guttata	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Dusky Woodswallow	Artamus cyanopterus cyanopterus	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Flame Robin	Petroica phoenicea	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Gang-gang Cockatoo	Callocephalon fimbriatum	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Grey-headed Flying-fox	Pteropus poliocephalus	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Large Bent-winged Bat	Miniopterus orianae oceanensis	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Little Eagle	Hieraaetus morphnoides	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Little Lorikeet	Glossopsitta pusilla	3348-Southern Tableland Granites Ribbon Gum Grassy Forest

NSW GOVERNMENT

BAM Predicted Species Report

Masked Owl	Tyto novaehollandiae	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Powerful Owl	Ninox strenua	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Rosenberg's Goanna	Varanus rosenbergi	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Scarlet Robin	Petroica boodang	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Speckled Warbler	Chthonicola sagittata	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Spotted Harrier	Circus assimilis	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Spotted-tailed Quoll	Dasyurus maculatus	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Square-tailed Kite	Lophoictinia isura	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Swift Parrot	Lathamus discolor	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
Varied Sittella	Daphoenositta chrysoptera	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
White-bellied Sea-Eagle	Haliaeetus leucogaster	3348-Southern Tableland Granites Ribbon Gum Grassy Forest
White-throated Needletail	Hirundapus caudacutus	3348-Southern Tableland Granites Ribbon Gum Grassy Forest

Threatened species Manually Added

None added

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Common Name	Scientific Name	Plant Community Type(s)
Glossy Black-Cockatoo	Calyptorhynchus lathami	3348-Southern Tableland Granites Ribbon Gum Grassy Forest

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C
Glossy Black-Cockatoo	Calyptorhynchus lathami	Habitat constraints

NSW GOVERNMENT

BAM Candidate Species Report

Proposal Details

Assessment Id 00042512/BAAS18022/23/00042513	Proposal Name Lithgow City Council subdivision 10 Col Drewe Drive South Bowenfels	BAM data last updated * 22/06/2023
Assessor Name Kate Hammill	Report Created 05/12/2023	BAM Data version * 61
Assessor Number BAAS18022	Assessment Type Part 4 Developments (General)	BAM Case Status Finalised
Assessment Revision 1	Date Finalised 05/12/2023	BOS entry trigger BOS Threshold: Area clearing threshold

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

List of Species Requiring Survey

Name	Presence	Survey Months
Asterolasia buxifolia Asterolasia buxifolia	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Callocephalon fimbriatum Gang-gang Cockatoo	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Calyptorhynchus lathami Glossy Black-Cockatoo	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

NSW GOVERNMENT

BAM Candidate Species Report

Chalinolobus dwyeri Large-eared Pied Bat	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Eucalyptus aggregata Black Gum	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Eucalyptus pulverulenta Silver-leafed Gum	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Leucochrysum albicans subsp. tricolor Hoary Sunray	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Ninox connivens Barking Owl	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Ninox strenua Powerful Owl	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

NSW GOVERNMENT

BAM Candidate Species Report

Phascolarctos cinereus Koala	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☑ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Thesium australe Austral Toadflax	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Tyto novaehollandiae Masked Owl	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Threatened species Manually Added

None added

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Booroolong Frog	Litoria booroolongensis	Habitat degraded
Brush-tailed Phascogale	Phascogale tapoatafa	Habitat degraded
Brush-tailed Rock-wallaby	Petrogale penicillata	Habitat degraded
Bush Stone-curlew	Burhinus grallarius	Habitat constraints
Eastern Pygmy-possum	Cercartetus nanus	Habitat degraded
Green and Golden Bell Frog	Litoria aurea	Habitat degraded
Grey-headed Flying-fox	Pteropus poliocephalus	Habitat degraded Habitat constraints
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints

NSW GOVERNMENT

BAM Candidate Species Report

Little Eagle	Hieraaetus morphnoides	Habitat constraints
Purple Copper Butterfly, Bathurst Copper Butterfly	Paralucia spinifera	Habitat constraints Geographic limitations
Southern Bell Frog	Litoria raniformis	Habitat degraded
Southern Greater Glider	Petauroides volans	Habitat degraded
Square-tailed Kite	Lophoictinia isura	Habitat constraints
Striped Legless Lizard	Delma impar	Habitat degraded
Stuttering Frog	Mixophyes balbus	Habitat degraded
Swift Parrot	Lathamus discolor	Habitat constraints
White-bellied Sea-Eagle	Haliaeetus leucogaster	Habitat constraints

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00042512/BAAS18022/23/00042513	Lithgow City Council subdivision 10 Col Drewe Drive South Bowenfels	22/06/2023
Assessor Name	**Report Created**	**BAM Data version ***
Kate Hammill	05/12/2023	61
Assessor Number	**BAM Case Status**	**Date Finalised**
BAAS18022	Finalised	05/12/2023
Assessment Revision	**Assessment Type**	**BOS entry trigger**
1	Part 4 Developments (General)	BOS Threshold: Area clearing threshold

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Southern Tableland Granites Ribbon Gum Grassy Forest												
1	3348_DNG	Not a TEC	10.3	10.3	4.6	PCT Cleared - 82%	High Sensitivity to Gain			2.00		0
											Subtotal	**0**
											Total	**0**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)									
3348_DNG	10.3	10.3	4.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	35
								Subtotal	**35**

BAM Credit Summary Report

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00042512/BAAS18022/23/00042513	Proposal Name Lithgow City Council subdivision 10 Col Drewe Drive South Bowenfels	BAM data last updated * 22/06/2023
Assessor Name Kate Hammill	Assessor Number BAAS18022	BAM Data version * 61
Proponent Names	Report Created 05/12/2023	BAM Case Status Finalised
Assessment Revision 1	Assessment Type Part 4 Developments (General)	Date Finalised 05/12/2023
BOS entry trigger BOS Threshold: Area clearing threshold	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Chalinolobus dwyeri / Large-eared Pied Bat

Additional Information for Approval

BAM Biodiversity Credit Report (Like for like)

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Calyptorhynchus lathami / Glossy Black-Cockatoo

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
3348-Southern Tableland Granites Ribbon Gum Grassy Forest	Not a TEC	4.6	0	0	0

BAM Biodiversity Credit Report (Like for like)

3348-Southern Tableland Granites Ribbon Gum Grassy Forest	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Tableland Clay Grassy Woodlands This includes PCT's: 513, 534, 554, 606, 722, 921, 1099, 3338, 3339, 3341, 3344, 3345, 3348	Tableland Clay Grassy Woodlands >=70% and <90%	3348_DNG	No	0	Bathurst, Burragorang, Hill End, Kanangra, Oberon, Orange and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Chalinolobus dwyeri / Large-eared Pied Bat	**3348_DNG**	4.6	35.00

Credit Retirement Options

Like-for-like credit retirement options

Chalinolobus dwyeri / Large-eared Pied Bat	Spp	IBRA subregion
	Chalinolobus dwyeri / Large-eared Pied Bat	Any in NSW

BAM Biodiversity Credit Report (Like for like)

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00042512/BAAS18022/23/00042513	Lithgow City Council subdivision 10 Col Drewe Drive South Bowenfels	22/06/2023
Assessor Name	Assessor Number	BAM Data version *
Kate Hammill	BAAS18022	61
Proponent Name(s)	Report Created	BAM Case Status
	05/12/2023	Finalised
Assessment Revision	Assessment Type	Date Finalised
1	Part 4 Developments (General)	05/12/2023
BOS entry trigger	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	
BOS Threshold: Area clearing threshold		

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Chalinolobus dwyeri / Large-eared Pied Bat		

Additional Information for Approval

PCT Outside Ibra Added

None added

BAM Biodiversity Credit Report (Variations)

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Calyptorhynchus lathami / Glossy Black-Cockatoo

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
3348-Southern Tableland Granites Ribbon Gum Grassy Forest	Not a TEC	4.6	0	0	0.00

3348-Southern Tableland Granites Ribbon Gum Grassy Forest

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Tableland Clay Grassy Woodlands This includes PCT's: 513, 534, 554, 606, 722, 921, 1099, 3338, 3339, 3341, 3344, 3345, 3348	Tableland Clay Grassy Woodlands >=70% and <90%	3348_DNG	No	0	Bathurst,Burragorang, Hill End, Kanangra, Oberon, Orange and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region

BAM Biodiversity Credit Report (Variations)

	Grassy Woodlands	Tier 2 or higher threat status	3348_DNG	No	0	IBRA Region: South Eastern Highlands, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Chalinolobus dwyeri / Large-eared Pied Bat	**3348_DNG**	4.6	35.00

Credit Retirement Options

Like-for-like options

Chalinolobus dwyeri/ Large-eared Pied Bat

Spp	IBRA region
Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW

Variation options

Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
Fauna	Vulnerable	Bathurst, Burragorang, Hill End, Kanangra, Oberon, Orange and Wollemi. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

12 Appendix D. Fauna survey report

Glossy Black-cockatoo *Calyptorhynchus lathami* surveys &Threatened Owl call play-back surveys

Location: Lot 1 DP1268778

Prepared for KHS Ecology & Bushfire

Applied Ecology P/L undertook threatened owl call playback surveys and Glossy Black-cockatoo fly-in surveys as part of BDAR development for the site by KHS Ecology & Bushfire P/L.

The site has been largely cleared and potentially historically overgrazed. The understorey is weedy and devoid of complexity and ground level refugia. Habitat features on the site include a small number of mature introduced and native trees, weedy creekline and remnant vegetation patches outside the lot to the north and south (Images 1-3 overleaf).

The following sections outline methodology and results.

Glossy Black-cockatoo surveys

Surveys were undertaken on the 17th and 21st of August 2023. The site was accessed via Robertson Street at ~4.30pm to undertake active watching for Glossy-black Cockatoos returning to the site to roost in nearby trees. Observations were made of whole of site from the observation point depicted in Figure 1. This vantage point provided clear sight lines to the subject trees from most directions. Two ecologists observed birds flying into and around the site using binoculars. Closer observations were made pre-dusk by walking slowly in a northward direction towards the subject trees.

Figure 1 Key areas of the survey

1

Image 2 Two living pines and 1 stag near the crest of the hill

Image 3 Looking west from the hill crest to scattered eucalypts in the paddock (approximately 100m) with weedy creek line below (approximately 400m).

Image 4 Scattered mature eucalypts north north-east of the hill crest.

Call Playback Methodology

Target species: Powerful Owl *Ninox strenua*, Barking Owl *Ninox connivens*, Australian Masked Owl *Tyto novaehollandiae*

Equipment: Toa ER 2215 loud haler, max power 23W. Owl recordings used will be a mix of own recordings, PK Birds and Dave Stewart recordings

Methodology: The calls of each target species were played intermittently for 5 minutes, followed by a 10-minute listening period (total 15 mins per species). After all the calls were played, another 10-15 minutes of listening along with searches with a thermal monocular (Hikmicro Falcon 35) were undertaken. Observers scanned the sky for approaching owls from the vantage point of the hill crest. The area was also swept with spotlights to check for birds that may have been attracted by the calls but were not vocalising.

Call-black sessions commenced at 6.45 and were typically completed by 7.30pm. Additional spotlighting was undertaken before and after call playback sessions.

Results

None of the target species were observed during surveys. Small parties of Galahs were observed around the site and flying into the subject trees on both survey days (Image 5). Galahs typically breed and lay eggs between August and November. Several pairs may breed in the same patch of trees within 10–80 m of each other. These hollows are defended throughout year, and most pairs roost nearby every night[1].

Image 5 Galahs on the subject site.

Laughing Kookaburras *Dacelo novaeguineae* were observed in the pines near the crest of the hill and also in native vegetation to the north. A family group is likely to breed in, and occupy, the site and surrounding vegetation (Image 6). Small mobs of Eastern Grey Kangaroos *Macropus giganteus* were

[1] *Rowley, I. and P. F. D. Boesman (2020). Galah (Eolophus roseicapilla), version 1.0. In Birds of the World (J. del Hoyo, A. Elliott, J. Sargatal, D. A. Christie, and E. de Juana, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.galah.01*

present on the subject site during both diurnal and nocturnal surveys (Images 7-9). The only arboreal mammal observed was the Common Ringtail Possum *Pseudocheirus peregrinus (Image 10)*.

Image 6 Laughing Kookaburras were observed in several trees and fencelines on the subject site

Image 7 Eastern Grey Kangaroos appear to be habituated to the presence of people and approached within 5m during surveys.

Image 8 Eastern Grey Kangaroo was largely unperturbed by owl calling (thermal image)

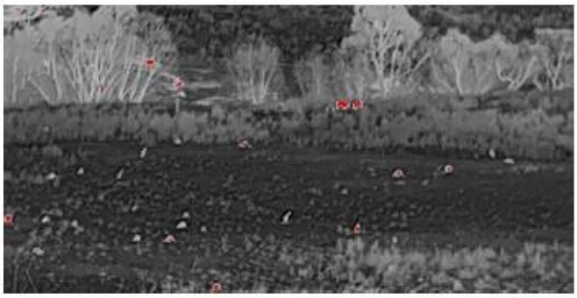


Image 9 Eastern Grey Kangaroos grazing to the west (thermal image)

Image 10 (left) Common Ringtail Possum feeding in a planted (?) Blackwood Wattle Acacia melanoxylon in the Council Reserve of Robertson Road

Other species observed or heard include *Litoria verreauxi* and *Crinia signifera* calling from the creek line, Red Wattlebird, Sulphur-crested Cockatoo and Grey Butcherbird.

13 Appendix E. Engineer's advice

J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS

Level 2, 50 Belmore Street
Penrith 2750
02 4720 3300
jwp@jwprice.com.au
www.jwprice.com.au

Our Ref: 110698-03 DA227-22
PK:pk

5 Dec 2023

Lithgow City Council

PO Box 19,
Lithgow NSW 2790

Attn: Sherilyn Hanrahan, Strategic Land Use Planner

Subject: DA227-22 10 Col Drewe Drive Bowenfels

Dear Sherilyn,

I refer to your email regarding concerns raised by KHS Ecology & Bushfire regarding the potential impacts on existing hollow bearing trees at each end of the proposed collector road in the subject Development Application.

Northern tree – Eucalyptus dives

As shown in the image below, the Eucalyptus dives and its protection zone are wholly impacted by the proposed temporary turning facility and its batters.

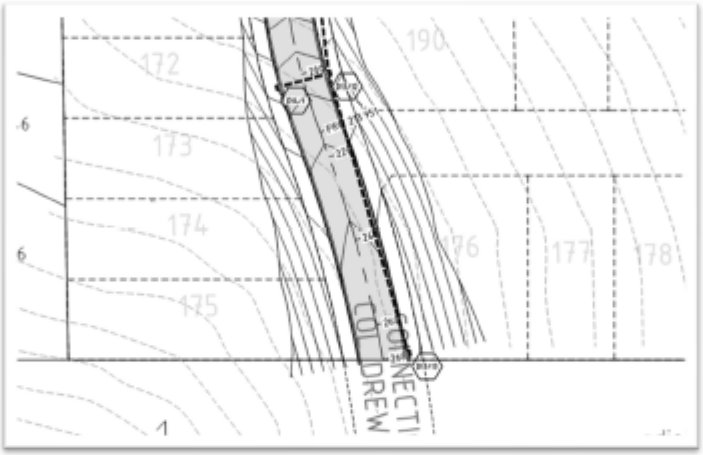
J. Wyndham Prince
Consulting Civil Infrastructure Engineers & Project Managers

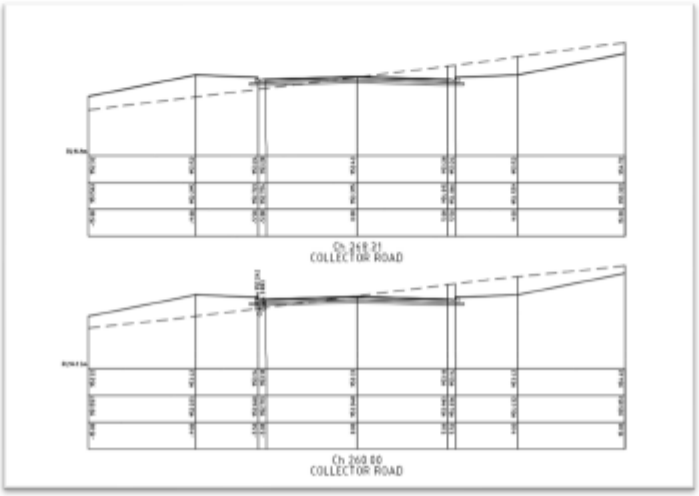
The alignment of the collector road within the subject site is fixed, as the adjoining property to the north (994 Great Western Highway, Lot 2 DP 1049398) has already received development consent for subdivision (DA142/18) with the collector road in that location.

The subject development application proposes to connect to the DA142/18 collector road and extend it southwards to Col Drewe Drive. The temporary turning facility is proposed to be installed only if DA142/18 has not constructed its section of collector road prior to the subject development construction.

As the land is mapped as bushfire prone land, the turning circles must comply with Planning for Bushfire Protection 2019 and have a diameter of at least 24m. Even if the temporary turning facility was wholly offset to the western side of the collector road alignment, the batters from the eastern side of the turning circle would still encroach within the tree protection zone.

It is noted that Subdivision Works Certificate plans for DA142/18 which show that the batters extend more than 6m into the adjacent proposed lot and impacting the Eucalyptus dives – see the images below showing the plan view and cross sections at chainages 260 and 268 with extent of batters.





As such, the Eucalyptus dives will be impacted irrespective of the proposed temporary turning facility.

Southern tree – Eucalyptus viminalis

As shown in the image below, the batter from the southern end of the proposed collector road encroaches into the tree protection zone of the Eucalyptus viminalis by approximately 7m.

The extent of the batter in this location can be reduced so as to not impact the Eucalyptus viminalis tree protection zone by the following methods:

1. The batter slope in this location varies between 1 in 4 and 1 in 5. These batter slopes could be made steeper – up to 1 in 3 in accordance with Council's Guidelines for Civil Engineering Design and Construction, or steeper with approval of the Group Manager Operations, and avoid impact the tree protection zone.
2. The extent of the batter could be reduced by the installation of retaining walls either at the toe of the batters or around the tree protection zone itself.

Unfortunately, the collector road levels cannot be adjusted as it needs to make a smooth connection to the extension of the existing Col Drewe Drive.

Should you have any queries regarding this matter please do not hesitate to contact me.

Yours faithfully

SENIOR PROJECT MANAGER